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(54) **Method of imaging an electrophotographic member and apparatus for carrying out the method.**

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Description

The field of the invention comprises apparatus and a method for imaging electrophotographic members by means of radiant energy devices such as lasers, the imaged electrophotographic members being thereafter used for printing. In the case of lithographic offset printing, the actual imaged member itself is treated to render toned and untoned parts hydrophobic and hydrophilic respectively and the member comprises the plate without further processing. In other cases, the toned electrophotographic member may be used as an information source by reading the images or projecting them if transparent or photographically reproducing them if desired. The preferred use of the invention is to make the printing plates upon metal such as stainless. Each of these substrates is coated with a type of photoconductive coating which will be described hereinbelow.

In the printing industry, printing plates for printing both graphics and text have in the past been produced manually with the graphics images being reproduced using the so-called half tone process. In this process several photographic steps are used to reproduce the graphics image in an array of dots of varying size to reproduce the image on the printing plate. Text information has in the past been hand set, but now may be set by machine under control of electronic devices.

Forming printing plates carrying both graphics and text images may involve several steps, especially when color graphics are to be reproduced. In such a case, several color separation plates must be made for each color to be printed with the text information located on the plate in which color is to be printed. When text information is to be located within the field of the graphics image, additional steps are required to form the solid printing areas for the plates in that particular color and to remove the graphics image from those same text areas on the remainder of color separation plates. This of course adds to the number of processed steps required to produce the desired graphics and text images. The steps of forming the graphics image to be printed in the graphics field is commonly known as overburning while the process of removing the graphics image from those same text areas in the other color separation plates to be printed is referred to or is commonly known as stripping.

In overburning, the negatives which form the graphics image and the text image to be formed in that field are overlayed one on another to form the desired color separation printing plate. In stripping, other techniques must be used to remove the graphics information from those same text image areas.

The process of forming printing plates containing both graphics and text data recently has been effected using essentially the same methods as were performed manually. Advanced systems however are able to compile from various input devices data which may be used to form both graphics and text information on a printing plate. But these systems have their drawbacks in that separate scanning cycles must be performed to form the graphics and text images on a single printing plate and in addition, complex switching circuits must be constructed to switch between text and graphics image formation when text images are to be formed within the field of a graphics image.

It is known from US-patent 4 004 079 to image an electrophotographic member in the form of an array of discharged elements of the surface of the member of such configuration and placement as to enable the member be used for reproducing imaging information of a first type and of a second type upon a receptor by printing or the like, wherein:

a) first data in the form of a series of first digital words from a source of such words representative collectively of the image information of the first type and

b) second data in the form of a series of second digital words comprised of bits from a source of such words representative collectively of the image information of the second type are acquiered;

c) the electrophotographic member upon which the image informations of the first and the second type are to be reproduced in the form of discharged elements, is charged,

d) controllable exposing means are provided being capable of selectively discharging single elements of groups of such elements of the electrophotographic member,

e) said controllable exposing means and the electrophotographic member are moved with respect to one another in accordance with an arrangement to scan the surface and adapted to have discharged elements in rows and columns on said surface and

f) said exposing means are controlled by control signals derived from said first and second digital words whereby discharged elements individual to the image information of the first type and discharged elements individual to the image information of the second type are produced intermixed on the electrophotographic member.

In the known system the apparatus is switched between a low resolution imaging mode and a high resolution imaging mode dependent from the desired reproduction of line and continuous tone graphic information, respectively. A similar imaging method as regards the switching over between two different imaging modes is known from US—patent 3 849 592. With the known systems it is only possible to provide two imaging modes with different resolution level, respectively, if the graphics information and the text information are located in different areas of the electrophotographic member.

It is an object of the present invention to image an electrophotographic member in one single run of a scanning operation with superimposed

graphics and text information without the need to expose the electrophotographic member during the whole scanning run in the high resolution mode.

Starting from a method of imaging an electrophotographic member of the general kind known from the above mentioned US—patent 4 004 079, the object outlined before is achieved in accordance with the present invention by method steps characterized in that

g) said controllable exposing means are capable to emit a group of individual rays, the group scanning one scanning line after the other directed towards the electrophotographic member and being individually modulated on and off,

h) first control signals are generated from said first digital words corresponding to a predetermined scaled density of an incremental area of graphic information,

i) said first control signals are used for modulating the individual rays of said exposing means,

k) second control signals are generated from said second digital words the states of the bits of each such second digital words corresponding to the binary densities of incremental areas of a text information and

l) the second control signals are used to control the modulation of the individual rays of the exposing means by said first control signals, whereby latent images comprising independent graphic and text information may be lad down upon said electrophotographic member surface in one scanning thereof by said exposing means.

By the invention there is also provided an apparatus for carrying out the method just described.

Formatting of the data is such that the graphics data contains information related to the relative scale densities of incremental areas of the graphics image with the reminder of the graphics data being a nullity to clear the surface of a charged electrophotographic member. The text data is formated such that it does not affect the formation of the images carried by the graphics data except in locations where text images are to be formed.

Formation of text images within the field of graphics images for several different color separation plates is performed simply by reversing the logical sense of a control bit of every text data digital word. Thus to produce text images of one color such as blue of a multi-color printed graphics image, the same data may be used for all of the color separation plages with the control bit for the color separation plate used to print the color blue set to one logical state and being set to the other logical state for the reminder of the separation plates.

Thus the apparatus and method of the invention provide for imaging of an entire printing plate with graphics and text information in a single pass of a beam of radiant energy.

Brief description of the drawings

Fig. 1 is a block diagram of an apparatus for making printing plates as constructed in accordance with the invention and uses the method of the invention;

Fig. 2 is a left-side elevation of the apparatus;

Fig. 3 is a plan view of the apparatus illustrated in Fig. 2 with the cover of the optical system and the cabinetry covering the drum removed;

Fig. 4 is a schematic diagram of the left-hand optical system of the apparatus;

Fig. 5 is a partial schematic diagram of the optical system illustrated in Fig. 4 taken along the lines 5—5 in the direction indicated;

Fig. 6 is a partial schematic diagram of the optical system illustrated in Fig. 4 and taken along the lines 6—6 in the direction indicated;

Fig. 7 is a partial schematic diagram of the optical system illustrated in Fig. 4 taken generally along the lines 7—7 in the direction shown;

Fig. 8 is a chart of a field of graphics images areas and text pixels which is used in the explanation of the invention;

Fig. 9 is a chart of a field of graphics pixels which is used in the explanation of the invention;

Fig. 10 is a chart of a field of text pixels overlaid with four graphics pixels, which is used in the explanation of the invention;

Fig. 11 is a more detailed block diagram of the electronics and optical system of the apparatus;

Fig. 12 is a more detailed block diagram of the pattern generators illustrated in Fig. 11;

Fig. 13 is a more detailed block diagram of the beam logic circuit illustrated in Fig. 11;

Fig. 14 is a chart illustrating which groups of individual rays are controlled by individual bits of text data words which is used in the explanation of the invention and

Fig. 15 is a more detailed block diagram of the multiplex and gating circuits of Fig. 13.

Description of the preferred embodiment

In the preferred embodiment, the imaging device receives digital data representing the graphics and text images to be printed or otherwise reproduced. This digital data is received from a compiling system which obtains raw data from such as optical scanning system, text input stations, etc., and compiles or formats the data representing the graphics and text materials into a form which may be used by the imaging device of the invention herein. The data received by the imaging device also may be generated or synthesized by a computer or by other means and may be presented to the imaging device from a memory in which it has been stored or it may be presented on line as it is generated or synthesized if the generation or synthesization rate if equal to or less than the imaging rate of an imaging device herein.

The output of the imaging device herein is an electrophotographic member carrying a toned latent image of charged and discharged incremental areas formed in response to the digital data. The toned member thereafter may be fused

and processed for use as a printing plate in an offset lithographic printing press with the toned areas carrying ink to a receptor to form the tonal grahics and text images. If color printing is desired, as many electrophotographic members carrying toned latent images are formed, as there are colors which are desired to be printed, one member carrying a toned latent image for each of what is commonly known as a color separation.

The imaging device or imager used in the preferred embodiment of this invention uses a lazer beam to image an electrophotographic member that includes a photoconductive coating that previously has been charged. The member is carried on a rotary drum, is toned on the drum and thereafter may be used to transfer the toned image or to serve as a medium for projection or printing of the image. In the case of printing, the toned image is used to carry ink in a printing press, the member having been treated to achieve hydrophilic and hydrophobic areas to enable offset lithographic use of member as a printing plate.

The preferred use of the image member herein is as a printing plate and has the same type of photoconductive imagable coating is preferably the receptor of the lazar beams which comprise the output from the apparatus of the invention. Such coating is that which is described and claimed in U.S. Patent 4,025,339.

The apparatus and method of the invention may best be understood by considering that the binary digital data input to the apparatus is used to binarily modulate a beam of radiant energy from a lazar to selectively discharge and leave changed incremental areas of a charged electrophotographic member. Thereafter, the selectively charged and discharged pattern or image carried on the member is toned and output from the apparatus.

The electrophotographic member is carried on the outer circumference of a drum which is rotated along its longitudinal axis. Charging, imaging and toning of the member on the drum occurs sequentially at adjacent stations as the member is moved past the stations by the rotating drum. Charging of the electrophotographic member may be of any means desired and in the preferred embodiment occurs by placing adjacent the outer circumference of the drum a wire having a high voltage applied thereto. Toning of the imaged member occurs by applying to the member a quantity of carrier fluid obtaining toner particles. The charging and toning occurring at stations respectively above and below an imaging plane. Imaging of the charged electrophotographic member occurs by passing a fine beam of radiant energy from a lazer across the surface of the member in image lines which are parallel to the longitudinal axis of the drum and lie in the imaging plane. Imaging of the entire surface of the charged member occurs in sequential image lines as the member is moved by the drum past the imaging plane.

The digital input to the imaging apparatus is in the form of two channels of graphics data and one channel of text data. Each digital word of the graphics data is used to form a picture element or a graphics pixel on the electrophotographic member. Every imaging line is comprised of two scan lines of graphics pixels with each channel of graphic's data respectively controlling the forming of graphics pixels in one scan line.

The text data controls the formation of text pixels across the entire scan line and therefore only one channel of text data is required. Every word of the text data is comprised of 8-bits of information with the least significant six bits each controlling the binary density of a text pixel, the next least significant bit serving as a control bit and the most significant bit not being used.

The graphics data and text data are formated such that they may individually form respective graphics or text images across the entire area of the electrophotographic member. The electronics of the invention herein uses both text and graphics data to form one channel of laser modulation signals. Further, in the imaging apparatus herein, the information carried by the text data is used to gate the formation of the individual rays of the fine beam of radiant energy, each of which rays are used to discharge an incremental area on the charged electrophotographic member. Simply stated, it may be thought of that the text data is used to gate or modulate the formation of graphics pixels in response to the graphic data. Thus if the text data is a nullity, no text images are to be formed on the member, the information carried by the graphics data will form the graphic image represented thereby and discharge the remainder of the member.

Where the text data contains information representing a text image to be formed on the member, the text data may either inhibit the formation of individual rays of the fine beam or depending on the logical state of the control bit included in each word of text data. When the text data inhibits the formation of individual rays of the fine beam, the text image is formed on the member which will be toned and in the printing plate will carry ink to the receptor to print a solid image. This is a case where black text is desired on any background. When the text data forms individual rays of the fine beam, text pixels are discharged on the member with the discharged areas of the member forming areas of the printing plate which do not print on the receptor or which remain clear. This is the case where clear text is desired within a graphics image. Within the preferred embodiment of the invention, the text pixels are nine times more mumerous than the graphics pixels, i.e., for every graphics pixel, there are nine text pixels which may be discharged or left charged. The resolution provided by the text pixels is not however nine times the resolution provided by the graphics pixels because of overlap of the text pixels. Of course it will be understood that the electrophotographic member is not physically divided into pixels of any type,

scan lines or image lines, and that these terms are used only to describe the operation of the imaging apparatus and method.

Referring now to Figure 1 of the drawings, the apparatus of the invention there as illustrated diagrammatically is indicated generally by the reference character 30. Two channels of graphics data are received by the apparatus respectively on channel A and channel B graphics data buffers 32 and 34. Text data is received into text data buffer 36. The graphics data contained in data buffers 32 and 34 individually are applied to pattern generators 38 and 40 over leads 42 and 44. In pattern generators 38 and 40, the density information carried by the digital words of the graphics data are converted into patterns of elements which are to be formed in graphics pixels on the member, the pixel patterns representing the densities indicated by the graphics data. The pattern information produced by pattern generators 38 and 40 then is applied to modulator 46 on leads 48 and 50 together with the text data from text data buffer 36 on lead 52. In modulator 46, the text data is used to modulate the pattern information from pattern generators 38 and 40. The output of modulator 46 which is applied to acousto-optic modulator 54 is the ray data which controls the formation of individual rays in the fine beam. The output of modulator 46 is carried to the acousto-optic modulator 54 on lead 56. A radiant energy source 58 is provided which produces a beam of radiant energy 60 essentially at one wavelength and which is directed to acousto-optic modulator 54. Radiant energy source 58 is in the preferred embodiment a lazar with the wavelength of the beam of radiant energy 60 being chosen to most advantageously discharge area of the electrophotographic member. Acousto-optic modulator 54 modulates the beam of radiant energy 60 to provide a fine beam 62 of radiant energy comprised of a plurality of individual rays and in some cases as little as a single ray.

The fine beam 62 is directed onto an electrophotographic member 64 carried on a drum 66 rotating in the direction indicated by arrow 68. The thickness of member 64 is exaggerated in Fig. 1 only so that member 64 may easily be seen on the circumference of drum 66. Charging of member 64 occurs at charging station 70 prior to the time at which fine beam 62 is applied to member 64 and toning of member 64 occurs after imaging by fine beam 62 at station 72.

It should be pointed out that while the preferred purpose of the invention is to make offset lithographic plates by electrostatic techniques described herein, any use of an electrophotographic member will find advantages where a member has been imaged according to the invention.

It will be appreciated that in forming several different color separation plates, it may be desired to form text images of a single color (for example blue text) in a field of a graphic image or otherwise. Thus in the blue printing separation plate, the text image must be found solid. On the other color separation plates that same area must be cleared so that only the color blue will be printed therein or the recepta. Thus by selectively using the solid forming and clearing capabilities of the text data, one may form the solid printing blue text image in the field of graphics or otherwise as may be desired.

Turning now to Fig. 2 and 3, the preferred embodiment of the digital plate maker is illustrated including some of the cabinetry provided therewith. The apparatus 30 includes an optical cabinet 80 which encloses a left-hand optical system 82 and a right-hand optical system 84. Drum 66 extends the width of the left-hand and right-hand optical systems 82 and 84 so that an electrophotographic member carried thereon may be simultaneously and separately imaged by respective optical systems. Drum 66 is supported at each end by supports 86 and 88 and is rotationally driven by motor 90. As shown in Fig. 2, the drum is enclosed by a housing 92, which protects a member carried on drum 66 from ambient light. Optical cabinet 80 and housing 92 adjoin each other there being only a small slit opening between them through which the fine beam passes on its way to the charged electrophotographic member.

The electrophotographic member is held on drum 66 by a magnetic chuck which is formed of magnetic strips extending the length of drum 66 at the circumference thereof. The magnetic field produced by these magnetic strips is strong enough so that an electrophotographic member having a substrate of such as stainless steel will be securely held on the drum. In the preferred embodiment, the drum circumference is 1250 mm. while the drum length is 1,100 mm. The drum is continuously rotated at a speed of 0.125 RPM which corresponds to 180 revolutions per day or 8 minutes per revolution. This provides a drum speed of 2.6 mm per second.

The center line of the charging station 70 is arranged to be 25 degrees above the image plane, while the center line of the toning station 72 is arranged to be 30 degrees below the imaging plane.

The maximum size electrophotographic member which may be carried by the drum 66 is a member which is 1,040 by 1,040 mm and the area of the member which may be imaged by each of the left and right hand optical system is 50 cm axial of the drum by 70 cm circumferential of the drum or an area which is 50,8×71,1 cm.

A cabinet is provided in which the toning tanks and pumps are contained with the hydraulic and nomadic connections between cabinet 94 and toning station 72 (not shown in the drawings for clarity purposes). Mounted on the exterior of cabinet 80 are two lazers 96 and 98, which provide the radiant energy respectively to the left-hand and right-hand optical systems 82 and 84. The entire apparatus 30 is supported by a frame 100 having the general configuration of a table. Auxiliary equipment for operating the apparatus

30 such as power supplied for the lazers 96 and 98 serve or control electronics for the motor 90 and auxiliary tanks for the toning system may be mounted under frame 100, and are not shown in Fig. 2 for clarity of the drawing.

As may be seen in Fig. 3, the left-hand and right-hand optical systems 82 and 84, are mirror images of one another so that a description of one is a description of the other. Referring also to Figs. 4, 5, 6 and 7, lazer 96 provided the beam of radiant energy 60 to spatial filter 110 which provides what may be termed a pinhole aperture to obtain a desired cross-sectional size of the beam. The beam 60 is transmitted through spatial filter 110 to folding mirror 112 which deflects beam 60 to beam splitter 114. A portion of beam 60 is transmitted through beam splitter 114 and forms a reference beam 118 which is deflected by folding mirror 120 and 122 to a spot forming lens 124. The portion of beam 60 which is deflected by beam splitter 114 is directed to acousto-optic deflector 54 which forms of beam 60 the individual rays which have been referred to as the fine beam 62. Fine beam 62 exits acousto-optic deflector 54 and passes through spot forming lens 126 and passes under folding mirror 128. Reference beam 118 passes through spot forming lens 124 as deflected by folding mirror 128. After fine beam 62 passes under folding mirror 128, fine beam 62 and reference beam 118 are vertically aligned with one another through the remainder of the optical path. Referring to Fig. 5, reference beam 118 which is transmitted through beam splitter 114 is represented by a crossed line indicating the light in reference beam 118 is exiting the drawing figure. Folding mirror 128 also is shown in Fig. 5 located above fine beam 62 after it passes through spot forming lens 126 and the circle at the center of folding mirror 128 representing that reference beam 118 is directed into drawing Fig. 5. Fine beam 62 and reference beam 118 then are deflected by folding mirror 130 with the crossed lines in Fig. 5 on folding mirror 130 indicating the light is exiting from the drawing figure while the circles on folding mirror 130 on Fig. 6 indicate that the light is entering the drawing figure.

Fine beam 62 and reference beam 118 then are passed through a relay lens 132 to a folding mirror 134. Again the crossed lines on folding mirror 134 on Fig. 6 representing that the beams are exiting the drawing figure. As also is shown in Fig. 7, beams 62 and 118 are deflected by folding mirror 134 through an fθ lens system 136 to a galvanometer mirror 138. Galvanometer mirror 138 is rotatably oscillated in the directions indicated by arrow 142 and directs fine beam 62 back through the fθ lens system 136 through an aperture 144 extending through the front plate 146 of cabinet 80 and then onto the charged electrophotographic member 64. Reference beam 118 is deflected by galvanometer mirror 138 back through fθ lens system 136 and onto a folding mirror 148 to an optical scale or grating system 150.

It will be noted that the deflection of fine beam 62 and reference beam 118 in horizontal directions by galvanometer mirror 138 does not disturb the vertical alignment of these two beams so that the position of reference beam 118 may be sensed by the optical scale or grating system and precisely locate the position of fine beam 62 which is used to image or write the images on the electrophotographic member 64. Galvanometer mirror 138 deflects fine beam 62 through a scan line 152 illustrated in Fig. 6 and deflects reference beam 118 along a scan line 154 lying on deflecting mirror 148. The extent to which the galvanometer mirror deflects fine beam 62 and reference beam 118 are represented in Fig. 4 by dashed lines 156.

It will be noted that as illustrated in Figs. 6 and 7, fine beam 62 and reference beam 118 are located below the imaging plane defined by fine beam 62 as it passes through aperture 144 and is directed onto electrophotographic member 64. The fθ lens system 136 provides field flattening for both fine beam 62 and reference beam 118 so that they may be maintained in focus respectively across the surface of the electrophotographic member and across the surface of the optical scale or grating system 150. It will be noted that the distance travelled by fine beam 62 along an optical path from spot focusing lens 126 to member 64 is equal to the distance travelled along the optical path by reference beam 118 from spot forming lens 124 to optical scale or grating system 150.

The spatial filter or folding mirrors, beam splitters, spot forming lenses, relay lens and galvanometer mirror are all common optical elements which readily may be constructed and arranged in a system as has been described as may be desired.

As has been stated digital data which is input to the digital platemaker is in the form of graphics data and text data. The graphics data is used to reproduce graphic images on the electrophotographic member 64 with one black and white image or one color separation image being formed on each member.

The graphics data is in the form of binary digital words with the value of each word representing a scaled areal density to be formed on an imaging area on the member. Each word is used to select a pattern of elements from a memory or other storage device which represents the scaled density equal to the value of the graphics digital word.

The patterns selected from the memory are formed on the member by discharging and leaving charged elements in an imaging area. The elements are arranged equispaced across the surface of the member and are arranged in rows and columns. Selective elements in the imaging areas are used to form the patterns and in the preferred embodiment are grouped together in irregular hexagonal picture elements or pixels. It should be remembered that the configuration of the pixels is a choice of the designer the imaging areas in which the configurations may be formed

being of a predetermined number of rows and of a predetermined number of columns. One pattern then may be formed in one pixel.

The columns at which the elements are located are defined by the lines which would be formed by the individual rays or beamlets of the fine beam 62 as they are passed across an imaging line. The rows of the imaging lines are defined by sample clock signals produced from the grating system 150.

The imaging lines are comprised of two scan lines of graphics pixels with each scan line of graphics pixels being controlled by one graphics data channel. Thus graphics channel controls the graphics pixels to be formed in scan line A, and the graphics data in channel B controls the graphics pixels to be formed in scan line B.

It bears repeating that if the text data contains no information to be formed on the electrophotographic member 64, the graphics data is formated so that the graphics image or images contained therein will be formed on the member 64 while the remainder of the surface of member 64 will be discharged. Thus the printing plate formed by such graphics and text data will print on the receptor only the graphics image or images and leave a clear background.

The text data is used to reproduce text images and line graphics such as charts and graphs on member 64. While the graphics data provides for the scale density of the imaging areas to be formed on member 64, the text data is used to provide binary imaging of image areas of the member 64 which in the preferred embodiment are the same as text pixels.

In the preferred embodiment the text pixels have a definite relationship to the graphics pixels.

In every imaging line the text pixels are aligned six abreast with the text pixels being two rows wide. Specifically, what may be called the first text pixel or scan line covers the area defined by the first four columns of individual rays by two rows deep. The next text pixel is three columns wide by the same two rows deep. The next two text pixels are each four columns wide and the same two rows deep. The next text pixel is three columns wide and the same two rows deep, and the last text pixel is four columns wide by the same two rows deep. Thus it may be said that the text pixels are arranged across the imaging line at every two rows. Every word of the text data represents the binary imaging to be formed in text pixels formed along the same two rows of the image line. For each of the six text pixels in those two rows, there are four possible states of conditions. The first two states are defined as being the normal states, the first of which will inhibit the formation of rays of fine beam 62 to leave charged areas of the member 62. These charged areas will form solid printing which will print such as black ink on a white background. The second condition is to enable the formation of individual rays of fine beam 62 as determined by the graphics data for that row. The last two states are defined as being the reverse mode, the first condition of the reverse causes a formation of rays of fine beam 62 to discharge areas of the member 64. These discharged areas will then form text images in areas otherwise formed of graphics images to provide printing plates which print clear text in graphics images. The last state of the reverse mode enables the formation of rays under control of the graphics data.

These four states are formed of the binary combination of a control bit and one data bit of every word of the text data. Thus as will be explained hereinafter, one data bit and one control bit of every word controls inhibiting of the formation of rays, enabling of formation of rays by the graphics data or causes the formation of rays in every text pixel.

If the graphics data is a nullity and is used only to clear the entire plate, then the information contained in the text data will be able to form text images only by inhibiting the formation of rays to leave charged areas which will print solid on the receptor. This is the first condition under the normal state. It will be noted that text images will not be able to be formed by the first condition of the reverse which causes the formation of rays because the graphics data is clearing the plate and there will be no background against which to form the clear text images.

If the graphics data is full density for the entire plate no rays will be formed anywhere across the plate by the graphics data. In such a case, the only text images which may be formed are under the reverse mode first condition which causes the formation of the rays to discharge areas in an undischarged field to print clear in a field of solid printing area. It will be noted that in such a case the first state or condition of the normal mode has no effect to create or form a text image by inhibiting the formation of rays because there are no rays being formed by the graphics data.

Thus the relationship between the graphics and text data may be described as one where the graphics data is able to form graphics images across the entire imaging area of the member 64 and depending upon the images so formed the text data may form text images. Moreover, the graphics data contains enough information to image across the entire imaging area of member 64 as does the text data with formation of patterns in the graphics pixels and the formation of the text pixels being entirely independent of one another. Imaging the graphics then text in this matter has advantages in that different imaging schemes for the graphics may be implemented without interfering between the relationship between the graphics and text imaging.

Referring now to drawing figures 8, 9 and 10, there is illustrated in fig. 8 a chart of three imaging lines which are formed on the electrophotoconductive member 64. Imaging lines 1 and 2 illustrate the formation of graphics pixels while image line 3 illustrates the formation of text pixels. Image lines 1 and 2 each comprise an A-channel scan line and a B-channel scan line, there being six thousand (6,000) image positions

in each of the A-channel and B-channel scan lines with the imaging positions in the B-channel scan lines being offset relative to the imaging positions in the A-channel scan lines. Thus in each of image lines 1 and 2, there are 6,000 graphic pixels which may be formed.

Referring now to Fig. 9, there is depicted a field of graphics pixels which may be presumed to be laid out on the surface of the electrophotographic member. The pixels are irregular hexagonal areas designated GP1, GP2, GP3, GP4 and GP5 inclusive and are parts of an overall pattern of hexagons which cover the surface of member 64. Obviously the defining lines illustrated in Figs. 8, 9 and 10 are imaginary and merely represent a theoretical geometric pattern which for convenience describes the manner in which the imaging is effected.

The individual rays of fine beam 62 are going to remove charge from the graphics pixel respectively. The possibility for removal is represented in this case by elements of discharge which are generally circular and which count for the entire interior of each graphics pixel. The graphics pixels according to the invention are arranged in interleaved columns so that the field of pixels may be considered to occupy all of the area. Graphics pixels GP1, GP2 and GP3 are shown with their flat sides respectively in common at 200 and 202 while the flat sides of graphics pixels GP4 and GP5 are in common at 204. The adjoining pixels to the left and to the right of these pixels are also arranged in this way but are not illustrated. The graphics pixels in adjacent scan lines are interleaved or staggered relative to one another hence pixels GP4 and GP5 have their top apexes at the location of the common flat sides 200 and 202 as indicated for example at 206 and 208. This interleaving is illustrated for adjoining scan lines in fig. 8.

Graphics pixels GP1, GP2, GP4 and GP5 have centering points laid out in them which are numbered and which can be seen to be formed at the junctures of rows and columns that are marked above and to the left of the field of pixels. The columns are defined as imaginary lines described by each of the individual rays of fine beam 62 as fine beam 62 is swept across each image line. The rows are defined along the image line by the optical grating system 150 and occur at equidistant intervals along every image line.

In the preferred embodiment, the image positions illustrated in Fig. 8 are defined as having six rows numbered 0—5 and 11 columns. Scan line A is formed of columns 1—11 while scan line B is formed of columns 12 through 22, the column numbers corresponding to the number of individual rays. While the graphic pixels GP1 through GP5 in the preferred embodiment have been defined as irregular hexagons having the number of elements illustrated, the graphic pixels may be defined as having any geometric configuration desired which fits the limitations of the six rows and eleven columns. As will be described more fully hereinafter concerning the electronics, the limitations of six rows and eleven columns is purely one of electronics such that by modifying the electronics any number of the number of columns and rows may be defined to be an imaged area and in turn any geometric configuration desired may be formed therein.

In the preferred embodiment there are 19 centering points for the elements in each graphics pixel and these are arranged in fifteen horizontal columns and six vertical rows. The columns are all confined within each graphics pixel between its top and bottom apexes. All graphics pixels are considered to be oriented exactly the same with their long flat surfaces left and right and apexes top and bottom. While the rows are formed somewhat differently. Five of the rows will have centering points that are within the confines of the graphics pixel between left and right flat sides, while the sixth row image will never have centering points located thereon is coincident with the left and right flat sides of the graphics pixels. This is a spacing expedient to be explained later.

The centering points which have been described are the centers of the circular dischargeable or formable elements such as 210 which are going to be discharged by the individual rays. As seen the circular element 210 which is the same as all others is large enough so that in addition to covering a certain area within its graphics pixel overlaps into adjoining pixel. Thus the circular element 210 not only discharges the area within the graphics pixel GP3 which it encompasses but also has a cordal slice or segment which it discharges at each of graphics pixels GP6 and GP7 as indicated at 212 and 214.

If we drew a line between each of the centering points vertically and diagonally, we would see the overall patterns of general hexagonal area which can be seen in the pixels GP1, GP2, GP4, GP5 and of course these hexagons have the appearance that they are made up of equilateral triangles. Thus the circular discharge elements such as 210 will discharge the area around its centering point comprised of the six equilateral triangle surrounding that centering point plus six more cordal segments beyond that hexagon defined by those triangles. And since every other circular element will also discharge the photoconductive surface of the electrophotographic member in the same way, the discharged circular elements which are side by side always overlap.

Graphics pixels GP3 has six of the top circular elements shown in outline at 216 and there overlapped areas are obvious. In addition, there can be seen the 8 overlapped cordal segments of discharge area that protrude into adjoining pixels including the pixels GP2 and GP7.

For explanatory purposes, the total discharged area of any graphics pixel can be approximated by the triangles which are included in the circular elements discharged. The more circular elements of discharge in a given graphics pixel equals the approximation because of the overlap within the graphics pixel. In the circular element 210 the

equilateral triangles are identified as TR1 to TR6 inclusive. It is illustrated in graphics pixels GP1 and GP4 that in the horizontal columns there is only one centering point in each of colums 1, 11, 12, and 22; two centering points in each of columns 2, 4, 6, 8, 10, 13, 15, 17, 19 and 21; and three points in each of columns, 3, 5, 7, 9, 14, 16, 18 and 20. These conditions are requirements of the electronics and may be altered by altering the electronics as is desired. In the preferred embodiment these conditions are requirements of the electronics and must be met during the laying down of the discharge elements.

The fine beam 62 which makes one pass to provide the horizontal column information for generation of the centering points for the graphics pixels which are being described in an image line will be composed of a maximum of 22 individual rays all passing over the total image line at any one time. It is assumed that all rays will be used for the graphics pixels in an image line but the maximum number of rays or beamlets that will be operating at any given time for the configuration illustrated in Fig. 9 will be 9, because as is illustrated in Fig. 9, there are no more than 9 centering points along any one row. This is shown in Fig. 9 and graphics pixels GP2 and GP4 have scan line A rows 0 and 1 and scan line B rows 4 and 5. Along scan line A row 0 and scan line B row 4 centering points 1, 2, 3 and 4 of graphics pixel 2 are defined while centering points 16, 17, 18, 19 and 20 of graphics pixel 4 are defined. Of course the minimum number of rays or beamlets operating will be zero.

Summarizing then, the horizontal columns of centering points are controlled by the number of individual rays in a fine beam 62. The rows are controlled by the information that is obtained from the optical grating system 150. The row information is used in the beam modulation electronics to discharge the desired elements as will be described hereinafter. The patterns which are imaged in the graphics pixels in response to the density values indicated by the digital words of the graphics data may be of any configuration desired to represent the equivalent density and the preferred embodiment, there is one predetermined pattern which is to be formed in the graphics pixels for every density value indicated by the graphics data.

In the preferred embodiment the distance between the center lines of scan line A and scan line B is 169.3 µm while the distance between the flat sides of each graphics pixel is 171.7 µm. The diameter at each of the discharged elements is 35 µm with all of these values being based upon a 6 lines per mm (150 line per inch) resolution.

It will be noted that as there are 24 individual elements in each graphics pixel which may be either charged or discharged there are a total of 2^{24} or approximately 16 million combinations of discharge elements which are available to image the desired density patterns. Thus, even if the graphics data may only represent 256 steps of density with 8 bits of information per graphics digital word, each step of the 256 step grade scale may be represented by a plurality of the 16 million available patterns which have density values equal to or approximately equal thereto.

The text pixels which are formed in response to the text data are illustrated in figs. 8 and 10. As shown in Fig. 8, the image line 3, there are six scan lines of text pixels per image line. The text pixels are arranged 3 wide for every graphics data scan line and are two rows deep. The arrangement of the text pixels relative to the graphics pixels and the rows and columns described hereinbefore is illustrated in figure 10.

The text pixels are arranged slightly shifted in relative to the graphics pixels, and there are about 9 text pixels per graphics pixels or graphics image area. Referring to fig. 8, along one image line there are 18,002 text pixel rows with six text pixels per row. The 18.002 rows of text pixels results by multiplying the 3,000 graphics pixel per scan line by 3 rows of text pixels per graphics pixel plus two additional rows of text pixels required to cover the area corresponding to the channel B pixels which are shifted relative to the channel A pixels.

The relationship of the text pixels to the graphics pixels in the A channel scan line and B channel scan line is illustrated in both figs. 8 and 10. The relationship of the text pixels to the columns defined by the individual rays is illustrated in fig. 10.

Fig. 10 illustrates text pixels 1—48 arranged along one image line and illustrates in dashed lines the relationship thereto of graphics pixels GP1, GP2, GP4 and GP5. The electronics of the digital platemaker system are arranged so that each word of the text data received thereby operates on 1 test pixel row of six abreast text pixels. Thus successive words of the text data operate on the rows of the text pixels TP1—TP6, TP7—TP12 TP13 through TP14, and so on.

The text pixels are defined as being that area which incloses a certain number of discharge elements which are formable by certain ways of the fine beam 62 across two successive graphic channel rows. By reference to Fig. 9 it will be seen that the rows indicated at the top of Fig. 10 correspond to the rows indicated at the top of Fig. 9. The areas enclosed by the text pixels with reference to the formable discharge elements are shown in Fig. 10 where text pixel 31 is formed of the area including the elements formed by rays 1, 2, 3 and 4 in the graphics A channel rows 3 and 4. Text pixel 32 is formed of the area including the elements formed by rays 5, 6 and 7 in the same rows 3 and 4. Text pixel 33 is formed of the area including the elements formed by rays 8, 9, 10 and 11 in the same rows 3 and 4. Text pixel 34 is formed of the area including the elements formed by rays 12, 13, 14 and 15 in the same rows three and 4. Text pixel 35 is formed of the area including the elements which are formed by rays 16, 17 and 18 in the same rows 3 and 4. And text pixel 36 is formed of the area including the

elements formed by rays 19, 20, 21 and 22 in the same rows 3 and 4.

Every text pixel of the field of text pixels across the entire imaging area of the member 64 of which the text pixel TP1—TP48 illustrated in Fig. 10 are representative, may be operated on one of four ways as has been described hereinbefore. These four ways result from the binary combination of one text information bit and one control bit of the digital words of the text data. These four states or conditions are divided into two modes, the normal mode and the reverse mode. In the normal mode the text data may inhibit the formation of rays in any text pixel, this inhibiting the formation of rays causing to leave the area of that particular text pixel charged which will be toned and will print solid upon a receptor. The second state of the normal mode is where the text data enables the formation of rays under control of the graphics data. The first state of the reverse mode causes the formation of rays in the area of a text pixel to form a clear text image in a field of a graphics image. On the receptor then the text will be clear within the confines of the printed image. The second state of the reverse mode is where the text data enables the formation of rays under control of the graphics data to produce a graphics image represented therein.

It therefore may readily be seen that the second states of the normal and reverse mode simply allows the formation of the graphics image carried by the graphics data. That the first state of the normal mode inhibits the formation of any rays or discharge elements in the entire area of the text pixels, and the first state of the reverse mode causes the formation of rays or discharge elements in a text pixel. Thus the member 64 may be imaged with text data to obtain a resolution which is three times finer than that obtainable using the graphics pixels. Further the text and graphics data does not have to be especially formated; nor does the electronics have to be constructed or arranged to switch back and forth between the text and graphics data.

In a manner similar to the predefined positions of the discharge elements of the graphics pixels, there are predetermined centering points or positions for the discharge of elements in the text pixels. It may readily be ascertained by viewing Fig. 10 that not all of the formable elements in a text pixel may be discharged to clear the total area of a text pixel during the first state of the reverse mode, only half the formable elements. In fact, it may be observed in Fig. 10 that only half of the dischargeable elements in any one text pixel need by discharged to discharge the entire area of that text pixel. This is illustrated in text pixel 43 wherein there are four discharged elements represented by the four circles 218. Thus it may be ascertained that by discharging the elements whose centering points have x or cross line as is illustrated text pixels TP32—TP36 the entire areas of those text pixels may be discharged. Thus it may be seen in the reverse mode, in the condition which causes the formation of rays to discharge the areas of the text pixels, only every other ray need be formed in any one row of dischargable elements, while in the next successive row only those elements which were not formed in the preceeding row need be formed. Thus in text pixel 31, rays 2 and 4 are formed in row 3 while rays 1 and 3 are formed in row 4. Thus to perform the reverse mode function which causes the formation of rays to discharge elements of the text pixel, the electronics need only form alternating rays in alternating rows. The formation of these rays in the reverse mode then may be described as text mode odd and text mode even, the odd and even referring to the desired rays which are to be formed in even numbered rows and the rays which are to be formed in the odd numbered rows. The implementation of this odd and even arrangement will be discussed more fully hereinafter in conjunction with the electronics.

The text data may be used to form solid printing areas such as alfanumerics, high receptor and further may be used to print on a receptor line graphics such as engineering drawings, charts, graphs, etc.

There are two sets of electronics or electrical systems for the digital platemaker, each electronic system being dedicated and acting in conjunction with only the left or righthand optical system. The electronics or electronics system is referred to the electronics required to receive graphics and text data and apply radio frequency signals to the acousto-optic deflector, which discharges incremental areas on the electrophotographic member 64. Both electronics systems perform the same functions and are identical to each other in all respects so that a description of one electronic system is a description of the other electronic system, and reference to an electronic system in conjunction with the modulation of the lazar beam in a singular refers to electronic systems of the left and right hand optical systems.

The electronics system illustrated in Fig. 1 generally illustrates the operation of both the electronic systems while the electronics system illustrated in Fig. 11 is a more detailed illustration of the same.

Data is input to the electronics system on input leads 250, which are illustrated with arrows having a width to illustrate that the input data is comprised of digital words having several parallel bits conveying the desired information. In the preferred embodiment the data is input to graphics data buffers 32 and 34 and text data buffers sequentially, that is to say that buffer 32 is loaded first, buffer 34 is loaded next and then buffer 36 is loaded last. The data contained in each buffer is the information or density values required to form graphics pixels along one scan line and text pixels across an entire image line. Inputting of the data to the buffers 32, 34 and 36 may be under control of such as a central controller 252 by way of leads 254. Central controller 252 may be interfaced with whatever

system that the text and graphics data are supplied from and may take form of a hard wired controller of a programmable controller as is desired. In the preferred embodiment, central controller 252 is a programmable microprocessor.

During an initialization period before the actual text and graphics data are input to the digital plate maker the patterns which are selected by the graphics data are loaded into the pattern generators 38 and 40 by way of input lead 250 under control of central controller 252. In this initialization period, data in form of the patterns which are to be loaded in the generators 38 and 40 are input into buffers 32 and 34 and carried by leads 42 and 44, leads 256 and 258 to the inputs of pattern generators 38 and 40 indicated by arrow heads 260 and 262. Thus, it may be determined that pattern generators 38 and 40 comprise memory devices which may be loaded, such devices being called random access memories or RAM. Loading of the pattern generators 38 and 40 is under control of central controller 252 by way of lead or leads 264. Suitable gating is provided which will be described hereinafter so that the graphics data carried by leads 42 and 44 to pattern generators 38 and 40 will not interfere with the patterns output by generators 38 and 40. After the initialization period had been completed and all the patterns are loaded into the pattern generators, the operational period of the imaging cycle is commenced in which the pattern generators become output devices.

Generation of the patterns is in response to graphics data applied to pattern generators 38 and 40 by way of leads 42 and 44. Control of the generation of patterns and indication of the location of fine beam 62 along the scanning line occurs by way of leads 264 from central controller 252. Central controller 252 is connected to optical grating system 150 by way of leads 266.

The output of pattern generators 38 and 40 are applied on leads 48 and 50 to beam logic 46 which also has applied thereto the text data over leads 52. Control of the beam logic including indication of the position of fine beam 62 along the scan line is from central controller 252 to beam logic 46 over leads 268.

In the beam logic the modulation of the graphics patterns to be formed by the individual rows are modulated by the text data as has been described hereinbefore with the output of the beam logic on leads 56 comprising the radio frequency signals required to produce the image indicated by the text and graphics data. Generation of the fine beam 62 and reference beam 118 is as has been previously described and therefore need not be redescribed. It suffices to say that optical path 270 illustrated in Fig. 14 generally comprises the optical elements between the acousto-optic deflector 54 and the electrophotographic member 64. Reference beam 118 is diagrammatically illustrated as being part of fine beam 118, after fine beam 62 exists the optical path 270. This is shown for illustration purposes only.

Turning now to Fig. 12, the pattern generators 38 and 40 are more specifically shown as is the gating required to load pattern generators 38 and 40 during the initial period. Latching line driver 280 is applied with data on leads 256, which in Fig. 12 are represented by single lines for clarity of the drawing. During the initial period in which patterns are loaded into pattern generator 38, the latching line driver 280 under control of leads 282 allows the data on leads 256 to pass therethrough and be input by channel A pattern RAM 284 which is placed in the read mode by lead 286. In a like manner, data which is supplied on leads 258 are applied to latching line driver 286, which during the initial period pass the data therethrough and it is input by channel B pattern RAM 288. Channel B pattern RAM is placed in the read mode also by lead 286. At the end of the initial period and at the commencement of the operation of the imaging cycle, latching line drivers 280 and 286 have their outputs placed to a tri-state level which places no load on leads 260, 48, 262 and 50. Thus in the operational period, the data appearing on leads 48 and 50 will be only the outputs of pattern RAMS 284 and 288.

During the operational period, graphics data is supplied to pattern generators 38 and 40 by way of leads 42 and 44. The graphics data is input therefrom to channel A latching counter 290 and channel B latching counter 292, respectively. The input of latching counters 290 and 292 is in the form of parallel words having 8 bits of information each. The output of latching counters 290 and 292 are 11 bits of information, the 8 most significant bits of the output being the same as the graphics data input thereto and the three least significant bits being generated in response to signals from the optical grating system. Loading of latching counters 290 and 292 is by way of a load lead 294.

To understand the selection of the patterns from the pattern RAMs 284 and 288, it must be understood that the value carried by each graphics data word represents a scaled density of an incremental area which is to be produced or reproduced on member 64. It further will be remembered as is illustrated in Figs. 9 and 10, the graphics pixels have a pattern produced in five sequential rows, the sixth row being used to space between graphics pixels. Thus to form one pattern in a graphics pixel, information must be applied to the acousto-optic deflector one row at a time to form the individual rays or beamlets required to discharge the elemental areas and produce the pattern indicated by the pattern RAMS 284 and 288. In the preferred embodiment, this generation of the patterns across the five rows of the graphics pixels occurs by using the value of the graphics words to select a group of addresses in the pattern RAMS and 288. Then a row clock signal produced from the signals produced by the optical grating system 150 is used to clock or step through the selected groups

of addresses. The outputs of the pattern RAMS 284 and 288 at each step of the group of addresses then are the binary indications of whether an individual ray is to be formed or not. Simply stated, the graphics words are used to select a group of memory locations while a row clock is used to step through the locations. The output of the memory step by step is the information needed to turn on or off the individual rays in fine beam 62.

Thus the clocks for latching counters 290 and 292 are applied on lead 296 and 298. The outputs of the pattern RAMS 284 and 288 are eleven bits of information each which are used to form the 22 individual rays.

The inputs to latching counters 290 and 292 are indicated as graphics data bits GD1—GD8. The outputs of latching counters 290 and 292 and the inputs to pattern RAMS 284 and 288 respectively are indicated as A-channel address leads AA0 through AA10 and B channel address leads BA0 through BA10. The output of pattern RAMs 284 and 288 are indicated as being pattern bits PB1 through PB11 and PB12 through PB22.

Concerning the stepping through the groups of memory location, it will be observed that three input bits 300 and 302 respectively of latching counters 290 and 292 are tied to ground. Thus when counters 290 and 292 are loaded by way of the signal on lead 294, the outputs AA0 and AA2 and BA0 to BA2 are at zero logic levels. Thus when clock signals are applied on leads 296 and 298, latching counters 290 and 292 respectively count up in binary manner from 0. Referring back to Figs. 8, 12 and 13, it will be noted that the rows are numbered accordingly as binary numbers from 0 to 5, which correspond respectively to the counts produced at the outputs of latching counters 290 and 292. It should further be noted that the rows for the A and B channels of graphics data are shifted relative to one another to form the desired irregular hexagons having apexes interleaved between one another. It therefore should be understood that the clocking of the channel A latching counter 290 commences earlier than the clocking of the channel B latching counter 292 to provide the patterns from the respective RAMS at the proper times.

The leads 282, 286, 294, 296 and 298 used to control the functions of the latching line drivers and pattern generators generally are the leads 264 indicated earlier in Fig. 11 coming from central controller 252.

In Fig. 13, there is illustrated in more detail the beam logic 46. In Fig. 13, pattern bits 1—22 are illustrated as being applied to a 22 bit one of four multiplexer 304 on one lead which is indicated as being 48 and 50. This is for clarity of the drawing. While multiplexer 304 is indicated as being one unit, which is able to select between one of four inputs, in the preferred embodiment multiplexer 304 is a plurality of multiplexers which may be individually or jointly operated upon. Beam logic 46 further comprises three switch arrays 306, 308 and 310, each of which supplies 22 individual leads of logic signals with each of the logic signals being controlled by a resistor switch network such as is illustrated in each block representing the switch arrays. Basically the network consists of the output lead being tied to a plus-5 volt souce through 1-K resistor, there being a programmable switch which may be closed to short the output lead to ground. When the switch is open, the logic level of the outputs of the switch arrays are at a logic of 1; while when the switches are closed the outputs are at logic state zero.

Array 306 is labelled as being the text reverse even switch array indicating that the outputs of this array indicate which of the individual rays are to be formed during a reverse mode even row indicated by the text data. The array 308 is labelled as being a text reverse odd switch array, the label indicating that the outputs of this array indicate the individual rays which are to be formed during a reverse mode odd row condition indicated by the text data. Array 310 is labelled as being a text normal switch array with its outputs indicating the rays which are to be inhibited. The outputs of each array, TRE1—TRE22, TRO1—TRO22 and TN1—TN22 are applied to the inputs multiplexer 304 over leads 306, 308 and 310 respectively.

Text data represented by text data bits TD1—TD8 at 312 of Fig. 13 are applied through a gating 314 to the A and B select inputs of multiplexer 304 on leads 316 and 318. Also applied to gating 314 is address lead AA0 from the A channel latching counter 290.

The outputs of multiplexer 304 are indicated as being ray data RD1—RD22, each output corresponding to the formation of an individual ray of fine beam 62 and acousto-optic deflector 54 from beam 60. The outputs of multiplexer 304 pass on lead 320 to a 22 bit latch 322, which holds the output data in response to a latch signal on lead 324. The output of the 22 bit latch is applied through leads 326 to 22 individual bit drivers 328, there being one individual bit driver for each of the output bits RD1 through RD22. The 22 bit drivers are enabled by a signal on lead 330 and provide their outputs by way of leads 332 to 22 RF oscillators 334, there being one RF or radio frequency oscillator for each of the signals from bit drivers 328 and the outputs of the 22 RF oscillators 334 appearing on leads 56 and being applied to acousto-optic deflector 54.

In operation of the beam logic circuit, instead of there being a straight forward gating of the pattern bits PB1—PB22 by the bits of the text data TD1—TD8, the bits of the text data are used to select for each of the groups of individual rays indicated in Fig. 10 between the four inputs to multiplexer 304, pattern bits, reverse mode even bits, reverse mode odd bits, and normal mode bits. But to this extent the illustration of multiplexer 304 in Fig. 13, as selecting between one of the four inputs for all of the ray data bits is somewhat misleading.

A better illustration of the multiplexing which occurs is illustrated in Fig. 15 with Fig. 14

illustrating in chart form which bits of the text data are used to modulate the individual rays. In Fig. 15, there is illustrated one of four multiplexer 336 having four groups of input bits, one group for each of the ray data bits output therefrom. As may be seen in Fig. 14, text data 1 is used to operate on or select the proper output for rays 1—4. Thus the outputs of one of four multiplexer 336 are indicated as being the ray data bits RD1 through RD4, these of course being the logic signals which determine whether or not rays 1—4 are formed or not. Thus to produce ray data bit R1, multiplexer 336 may select one of pattern bit 1, text reverse even bit 1, text reverse odd bit 1 and text normal bit 1. Multiplexer 336 may make a light selection for each of ray data bits RD2—RD4. It should be remembered that when the ray data bits are such as a logic of 1, they indicate that an individual ray should be formed in fine beam 62 while when the ray data bits are at a logic of zero (0), they indicate that no individual ray should be formed in fine beam 62.

Concerning gating 314 which is illustrated more fully in Fig. 15, it should be remembered that binary combination of a control bit which is shown in Fig. 14 to be the text data bit TD7 and an information bit such as text data bit TD1 which are used to select between the four states. Gating circuit 314 provides for this in addition for providing for the turning on of the desired individual rays during a reverse mode and the even and odd rows.

To this end, it will be noted that a signal which is a logic level 1 indicating that the beam logic is out of the text mode is applied to norgate 340 to lead 342, that the output thereof is a logic of zero (0) which is applied to AND gates 344 and 346 on lead 340 respectively. The outputs of AND gates 344 and 346 thus may only be a logic of zero (0) which would apply to the A and B outputs of multiplexer 336 selects the pattern bits to be output as the ray data bits RD1—RD4. The same thing occurs when the T1 input to norgate 340 is a logic of 1, indicating that the pattern bits generated by the graphics data are to be formed in the text pixel or pixels corresponding to rays R1—R4. When the text mode signal is a logic of zero (0) and the TD1 is a logic of 0 (zero), then the output of Norgate 3—4 is a logic of 1, which enables AND gate 344 and 346 to provide signal which will select other than the graphics data to be formed in text pixels corresponding to rays R1—R4.

In such a case, if signal TD7 is a logic of 1, indicating a normal mode, then the outputs of norgates 350 and 352 also will be a logic of 1, which is applied respectively by way of leads 354 and 356 to AND gates 344 and 346. The outputs of AND gates 344 and 346 then will both be logic of 1, which will select as the ray data bits RD1—RD4 the logical levels appearing on the signals labelled TN1—TN4 or text normal. The outputs from the text normal switch array 310 illustrated in Fig. 13 thus must be programmed in logical zeros (0's) so that the formation of individual rays R1—R4 is inhibited. It may be stated at this time that switch arrays 306, 308, 310 are provided in the preferred embodiment to provide versatility of the apparatus.

Further in the case where the signals on lead 342 and the logic level of bit TD1, the logical zeroes, if the TD7 signal is a logical zero indicating the reverse mode, then the outputs of Nor gates 350 and 352 will be controlled by the logical level input thereto by the A channel address bit zero, A—A zero. It will be understood that this signal A—A zero is continuously being oscillated between a logic of zero and a logic of 1 state, as the fine beam 62 is passed across the surface of the electrophotographic member 64. Thus when bit TD7 is a logical zero, the output of Or gate 350 is directly controlled by the logical level of signal A—A zero, while the output of OR gate 52 is the inverse thereof due to inverter 358. Thus for an even row, the outputs provided by AND gates 344 and 346 will be such that multiplexer 336 outputs as ray data bits RD1—RD4 the logical levels appearing at the signals TRE1 through TRE4. At an odd number row, logic levels output by multiplexer 336 as ray data bits RD1—RD4 will be the logical levels input thereto by signals TRO1—TRO4.

It will be appreciated that the one of four multiplexer used to form the ray data bit RD1—RD4 is an example of the multiplexer circuit used to provide the ray data bits for each of the groups of rays illustrated in connection with the text pixels of Fig. 10. The gating circuit 314 also is the same for each of those multiplexer circuits with only the information bit TD1 being changed for the groups of rays to the corresponding text data bit.

Claims

1. A method of imaging an electrophotographic member (64) in the form of an array of discharged elements of the surface of the member of such configuration and placement as to enable the member to be used for reproducing image information of a first type and of a second type upon a receptor by printing or the like, wherein:

a) first data in the form of a series of first digital words from a source (32, 34) of such words representative collectively of the image information of the first type and

b) second data in the form of a series of second digital words comprised of bits from a source (36) of such words representative collectively of the image information of the second type are acquired;

c) the electrophotographic member upon which the image informations of the first and the second type are to be reproduced in the form of discharged elements, is charged (70),

d) controllable exposing means (58, 54) are provided being capable of selectively discharging single elements of groups of such elements of the electrophotographic member,

e) said controllable exposing means and the

electrophotographic member are moved with respect to one another in accordance with an arrangement to scan the surface and adapted to have discharged elements in rows and columns on said surface and

f) said exposing means (58, 54) are controlled by control signals (56) derived (46) from said first and second digital words whereby discharged elements individual to the image information of the first type and discharge elements individual to the image information of the second type are produced intermixed on the electrophotographic member,

characterized in that

g) said controllable exposing means (58, 54) are capable to emit a group of individual rays, the group scanning one scanning line after the other directed towards the electrophotographic member (64) and being individually modulated (54) on and off,

h) first control signals (48, 50) are generated from said first digital words corresponding to a predetermined scaled density of an incremental area of a graphic information,

i) said first control signals (48, 50) are used for modulating the individual rays of said exposing means,

k) second control signals (52) are generated from said second digital words the states of the bits of each such second digital word corresponding to the binary densities of incremental areas of a text information and

l) the second control signals (52) are used to control the modulation of the individual rays of the exposing means by said first control signals, whereby latent images comprising independent graphic and text information may be laid down upon said electrophotographic member surface in one scanning thereof by said exposing means.

2. A method in accordance with claim 1, characterized by the following steps for generating said first control signals:

generating sample signals which are indicative of the relative movement between said exposing means (58, 54) and said electrophotographic member (64); providing a store of area weighted graphics patterns, each graphics pattern being individual to a predetermined scaled density of a graphics pixel which is to be reproduced upon the electrophotographic member; applying the first digital words and the sample signals simultaneously to the store, each first digital word being applied while a sequentially produced group of a first particular number of the sample signals is applied, the first digital words each being effective to select a group of signals representative of a particular graphics pattern which will result in the graphics pixel upon the application of the rays of said exposing means; the sample signals being effective to control the rows in the graphics pixel where there will be discharged elements to form the graphics pattern within the graphics pixel and the area weighted graphics pattern chosen by the first digital word being effective to control the columns of the graphics pixel where there will be discharged elements to form the graphics pattern and the output from the store comprising, for each first digital word and each row chosen, a plurality of beam modulating control signals describing the discharge elements for the graphics pixel.

3. A method in accordance with claim 2, characterized by the following step for generating said second control signals:

providing an array of binary text patterns, each pattern being individual to a binary density of a text pixel which is to be reproduced upon the electrophotographic member and the output of the array comprising a plurality of constantly applied text beam modulating control signals describing the discharge elements for every row of the text pixels.

4. A method in accordance with claim 3, characterized in that the graphics and text beam modulating control signals, the second digital words and the sample signals are applied simultaneously to a multiplexer (304), each second digital word being applied while a sequentially produced group of second particular numbers of the sample signals is applied, the second beam modulating control signals being constantly applied, the first beam modulating control signals (48, 50) being sequentially applied as they are output from the store, and the bits of the second digital words being effective to select in groups of beam modulating control signals for each row, one of the first and second beam modulating control signals (52) to be output from the multiplexer as the output beam modulating signals.

5. Apparatus for carrying out the method in accordance with claim 1, characterized by first buffer means (32, 34) for receiving said first data in the form of a series of said first digital words, second buffer means (36) for receiving said second data in form of a series of said second digital words, pattern generator means (38, 40) for receiving in sequence said first data one first digital word at a time for generating in response thereto, graphic pattern density signals representative of respective different first digital words, beam logic means (46) for producing beam logic control signals in response to said graphics pattern density signals, the beam logic means also receiving said first digital words for modulating the graphics pattern density signals in response thereto to form resultant beam control signals, means (58) for providing a fine beam of radiant energy consisting of a group of individual rays and directing the beam against the electrophotographic member (64) to cause discharge of elements thereof, each ray if not extinguished being capable of discharging a single element when impinging against the electrophotographic member and modulating means (54) for modulating said rays in accordance with said beam modulating signals whereby independently graphics and text latent images may be laid down upon said electrophotographic member surface on one scanning thereof by said fine beam of radiant energy.

Patentansprüche

1. Verfahren zum Erzeugen eines Bildes auf einem elektrophotographischen Bildtrager (64) in Form einer Anordnung von entladenen Flächenelementen der Oberfläche des Bildträgers in einer solchen Form und Anordnung, daß der Bildträger für die Reproduktion von Bildinformationen einer ersten Art und einer zweiten Art auf einem Bildaufnehmer durch Drucken oder dergleichen verwendbar ist, in dem

a) erste Daten in Form einer Folge von ersten Digitalworten, die von einer Quelle (32, 34) derartiger Worte kommen und gemeinsam die Bildinformation der ersten Art darstellen und

b) zweite Daten in Form einer Folge von zweiten Digitalworten, die aus Bits bestehen und von einer Quelle (36) derartiger Worte kommen und gemeinsam die Bildinformation der zweiten Art darstellen, deschafft werden;

c) der elektrophotographische Bildträger, auf dem die Bildinformationen der ersten und der zweiten Art in Form von entladenen Flächenelementen reproduziert werden sollen, geladen wird (70),

d) eine steuerbare Exponiereinrichtung (58, 54) vorgesehen wird, die geeignet ist, einzelne Elemente von Gruppen derartiger Flachenelemente des elektrophotographischen Bildtragers selektiv zu entladen,

e) die steuerbare Exponiereinrichtung und der elektrophotographische Bildträger relativ zueinander gemäß einer Anordnung derart bewegt werden, daß die Oberfläche abgetastet und auf ihr entladens Flächenelemente gebildet werden, die aus der uberflache in Zeilen und Kolonnen angeordnet sind, und

f) die Exponiereinrichtung (58, 54) durch Steuersignale (56) gesteuert wird, die von den ersten und den zweiten Digitalworten abgeleitet (46) sind, so daß auf dem elektrophotographischen Bildträger miteinander vermengte entladene Flächenelemente gebildet werden, die Bildinformation der ersten bzw. der zweiten Art darstellen,

dadurch gekennzeichnet, daß

g) die steuerbare Exponiereintichtung (58, 54) geeignet ist, eine Gruppe von Einzelstrahlen zu emittieren, mit denen eine Abtastzeile nach der anderen abgetastet wird und die auf den elektrophotographischen Bildträger (64) geworfen und durch eine Modulation (54) einzeln ein- und ausgeschaltet werden,

h) von den ersten Digitalworten erste Steuersignale (48, 50) abgeleitet werden, die einer vorherbestimmten Dichtestufe einer Inkrementalfläche einer graphischen Information entsprechen,

i) die ersten Steuersignale (48, 50) zum Modulieren der Einzelstrahlen der Exponiereinrichtung verwendet werden,

k) von dem zweiten Digitalworten zweite Steuersignale (52) abgeleitet werden, wobei die Bitzustande jedes dieser zweiten Digitalenworten die binären Dichten von Inkrementalflächen einer Textinformation darstellen, und

l) die zweiten Steuersignale (52) zur Steuerung der durch die ersten Stuersignale bewirkten Modulation der Einzelstrahlen der Exponiereinrichtung verwendet werden, so daß auf der Oberfläche des elektrophotographische Bildträgers bei einer Abtastung derselben durch die Exponierrichtung latente Bilder erzeugt werden könne, die eine graphische und eine Textinformation enthalten, die voneinander unabhängig sind.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß zum Erzeugen der ersten Steuersignale folgende Schritte durchgeführt werden:

Es werden Abtastsignale erzeugt, die die Relativbewegung zwischen der Exponiereinrichtung (58, 54) und dem elektrophotographischen Bildträger (64) darstellen; es wird ein Speicher von flächengewichteten Graphikmustern vorgesehen, die vorherbestimmten Dichtestufen eine Graphik-Bildelements zugeordnet sind, das auf dem elektrophotographischen Bildträger reproduziert werden soll; die ersten Digitalworte und die Abtastsignale werden gleichzeitig an den Speicher angelegt, wobei jedes erste Digitalwort zu einer Zeit angelegt wird, in der eine Gruppe von in einer bestimmten Anzahl nacheinander erzeugten Abtastsignalen angelegt wird, wobei jedes der Digitalworte eine Gruppe von Signalen auswählt, die ein bestimmtes Graphikmuster darstellen, das durch die Einwirkung der Strahlen der Exponiereinrichtung erzeugt wird, die Abtastsignale jene Reihen des Graphik-Bildelements bezeichnen, die entladene Flächenelemente zur Bildung des Graphikmusters in dem Graphik-Bildelement enthalen, das von dem ersten Digitalwort ausgewählte, flächengewichtete Graphikmuster die Spalten des Graphik-Bildelements bezeichnet, die entladene Flächenelemente zur Bildung des Graphikmusters enthalten, und der Ausgang des Speichers für jedes erste Digitalwort und jede gewählte Reihe eine Mehrzahl von strahlenbündelmodulierenden Steuersignalen enthält, die die in dem Graphik-Bildelement zu entladenden Flächenelemente bezeichnen.

3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß zum Erzeugen der zweiten Steuersignale eine Anordnung von binären Textmustern erzeugt wird, die der binären Dichte je eines der Text-Bildelemente angeben, die auf dem elektrophotographsichen Bildträger reproduziert wergen sollen, wobei der Ausgang der Anordnung eine Mehrzahl von ständig angelegten strahlenbündelmodulierenden Steuersignalen enthält, die die in jeder Reihe der Text-Bildelemente zu entladenen Flächenelemente angeben.

4. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß die strahlenbündelmodulierenden Steuersignale für die Graphik und den Text, die zweiten Digitalworte und die Abtastsignale gleichzeitig an einen Multiplexer (304) angelegt

werden, wobei jedes zweite Digitalwort zu einer Zeit angelegt wird, in der eine Gruppe von in einer zweiten bestimmten Anzahl nacheinander erzeugten Abtastsignalen angelegt wird, die zweiten strahlenbündelmodulierenden Steuersignale ständig angelegt werden, die ersten strahlenbündelmodulierenden Steuersignale (48, 50) entsprechend ihrer Ausgabe aus dem Speicher nacheinander angelegt werden, und die Bits der zweiten Digitalworte in Gruppen von strahlenbündelmodulierenden Steuersignalen für jede Reihe eines der ersten und zweiten strahlenbündelmodulierenden Steuersignale (52) auswählen, das von dem Multiplexer als strahlenbündelmodulierendes Ausgangssignal abgegeben werden soll.

5. Vorrichtung zur Durchführung des Verfahrens nach Anspruch 1, gekennzeichnet durch einen ersten Zwischenspeicher (32, 34) zum Empfang der ersten Daten in Form einer Folge der ersten Digitalworte, durch einen zweiten Zwischenspeicher (36) zum Empfang der zweiten Daten in Form einer Folge der zweiten Digitalworte, durch einen Mustergeber (38, 40) zum Empfang der ersten Daten in Form von aufeinanderfolgenden ersten Digitalworten und zum Erzeugen von je einem der ersten Digitalworte entsprechenden Graphikmuster-Dichtesignalen, durch eine logische Strahlenbündel - Steuerschaltung (46) zum Erzeugen von strahlenbündelsteuerenden logischen Signalen, wobei die logische Strahlenbündel-Steuerschaltung ebenfalls die ersten Digitalworte empfängt und auf Grund derselben die Graphikmuster-Dichtesignale unter Erzeugung von strahlenbündelsteuernden Signalen moduliert, durch eine Einrichtung (58) zum Erzeugen eines feinen Strahlungsenergiestrahlenbündels, das aus einer Gruppe von Einzelstrahlen besteht, und zum Richten des Strahlenbündels auf den elektrophotographischen Bildträger (64), um Flächenelemente desselben zu entladen, wobei jeder nicht gelöschte Strahl geeignet ist, beim Auftreffen auf dem elektrophotographischen Bildträger ein einzelnes Flächenelement zu entladen, und durch eine Moduliereinrichtung (54) zum Modulieren der genannten Strahlen in Abhängigkeit von den strahlenbündelmodulierenden Signalen, so daß während einer Abtastung der Oberfläche des elektrophotographischen Ladungsträgers durch das feine Strahlenbündel aus Strahlungsenergie auf der genannten Fläche ein latentes Graphikbild und ein latentes Textbild unabhängig voneinander erzeugt werden können.

Revendications

1. Procédé de faire une image d'un membre électrophotographique (64) sous forme d'un ordre des éléments déchargés de la surface dudit membre de telle configuration et positionnement, afin que ledit membre soit mis en état à se servir dans la reproduction d'un premier type d'information d'image et d'un deuxième type d'information d'image, sur un porteur, par impression ou un procédé semblable, dans lequel:

a) on extrait des premières données sous forme d'une suite des premières données numériques élémentaires d'une source (32, 34) des telles données élémentaires, représentatives collectivement dudit premier type des informations d'image, et

b) on extrait des deuxièmes données sous forme d'une suite des deuxièmes données numériques élémentaires, composées des bits, d'une source (36) de telles données élémentaires, représentatives collectivement dudit deuxième type des informations d'image;

c) ledit membre électrophotographique, sur lequel les premier et deuxième types d'informations d'image sont à reproduire sous forme des éléments déchargés, est chargé (70);

d) dans lequel des moyens d'exposition (58, 54) contrôlables sont prévus, qui sont aptes à un déchargement sélectif des éléments individuels dans des groupes des tels éléments dudit membre électrophotographique;

e) dans lequel lesdits moyens d'exposition contrôlables et ledit membre électrophotographique sont mis en mouvement l'un par rapport à l'autre selon une disposition afin qu'ils balaient la surface, ladite disposition étant apte à comprendre des éléments déchargés dans des lignes et colonnes sur ladite surface,

f) et dans lequel lesdits moyens d'exposition (58, 54) sont contrôlés par des signaux de commande (56) dérivés desdites premières et deuxièmes données numériques élémentaires, afin que des éléments déchargés individuels et respectivement représentatifs dudit premier type d'informations d'image et des éléments déchargés individuels et respectivement représentatifs dudits deuxième type d'informations d'image soient produits en arrangement mixte, sur ledit membre électrophotographique, caractérisé en ce que

g) lesdits moyens d'exposition contrôlables (58, 54) sont susceptibles d'émettre une groupe des rayons discrètes vers ledit membre électrophotographique (64), ladite groupe balayant les lignes de lecture l'une après l'autre, pendant que lesdits moyens sont modulés individuellement (54) en fonction on-off;

h) des premiers signaux de commande (48, 50) sont engendrés à partir desdites premières données numériques élémentaires qui correspondent à une densité graduée déterminée d'un domaine incrémentiel d'une information graphique;

i) lesdits premiers signaux de commande (48, 50) sont appliqués à la modulation desdits rayons individuels desdits moyens d'exposition;

k) des deuxièmes signaux de commande (52) sont engendrés à partir desdits deuxièmes données numériques élémentaires, les états des bits de chacune desdites deuxièmes données numériques élémentaires correspondant aux

densités binaires des domaines incrémentiels d'une information texte.

l) et en ce que lesdits deuxièmes signaux de commande (52) sont appliqués à contrôler la modulation desdits rayons individuels desdits moyens d'exposition par l'intermédiaire desdits premiers signaux de commande, des images latentes comprenant des informations graphiques et texte indépendantes, étant, le cas échéant, déposées sur la surface dudit membre électrophotographique au cours d'un cycle de balayage de ladite surface par lesdits moyens d'exposition.

2. Procédé selon la revendication 1, caractérisé en ce qu'il comprend une suite des opérations suivantes donnant lieu à la formation desdits premiers signaux de commande:

— engendre des signaux-échantillons indicateurs de mouvement relatif entre lesdits moyens d'exposition (58, 54) et ledit membre électrophotographique (64)
— pourvoir une mémoire pour des arrangements graphiques pondérés par domaine, chacune desdits arrangement graphiques étant individuellement représentatif d'une densité graduée déterminée d'un élément graphique d'image à reproduire sur ledit membre électrophotographique;
— appliquer lesdites premières données numériques élémentaires et, en même temps, lesdits signaux-échantillons à la mémoire, chacune desdites premières données numériques élémentaires étant appliquée simultanément à l'application d'une groupe engendrée séquentiellement d'une premier nombre défini desdits signaux-échantillons, et chacune desdites premières données numériques élémentaires agissant d'une façon qu'une groupe des signaux soit choisie qui sont représentatifs d'un arrangement graphique particulier, aboutissant audit élément graphique d'image après l'application desdits rayons provenant desdits moyens d'exposition;
— lesdits signaux-échantillons donnant lieu à la commande des lignes dans ledit élément graphique d'image dans lequel se trouvent des éléments déchargés pour la formation dudit arrangement graphique au dedans dudit élément graphique d'image, et ledit arrangement graphique pondéré par domaine, choisi par ladite première donnée numérique élémantire, donnant lieu à la commande des colonnes dudit élément graphique d'image dans lequel se trouvent des éléments déchargés pour la formation dudit arrangement graphique,
— et la sortie de la mémoire, comprenant plusieurs signaux de commande modulateurs de rayons pour chacune desdites premières données numériques élémentaires et pour chacune des lignes choisies, aboutissant à la définition des éléments de décharge pour ledit élément graphique d'image.

3. Procédé selon la revendication 2, caractérisé par l'opération suivante donnant lieu à la formation desdits deuxièmes signaux de commande:

— fournir un ordre des arrangements texte binaires, chacune desdits arrangement texte étant individuellement représentatif d'une densité binaire d'un élément d'image texte à reproduire sur ledit membre électrophotographique, et la sortie dudit ordre comprenant plusieurs signaux de commande modulateurs de rayon texte appliqués constamment, aboutissant à la définition des éléments de décharge pour chaque ligne desdits éléments d'image texte.

4. Procédé selon la revendication 3, caractérisé en ce que lesdits signaux de commande modulateurs de rayon texte, lesdites deuxièmes données numériques élémentaires et lesdits signaux-échantillons sont simultanément appliqués à un multiplexeur (304), dont chacune desdites deuxièmes données numériques élémentaires est appliquée au cours de l'application d'une groupe engendrée séquentiellement des deuxièmes nombres particuliers des signaux-échantillons, pendant que lesdits deuxièmes signaux de commande modulateurs de rayon sont constamment appliqués, lesdits premiers signaux de commande modulateurs de rayon (48, 50) étant séquentiellement appliqués dans leur succession de sortie de mémoire, et les bits desdites deuxièmes données numériques élémentaires donnant lieu à la sélection parmi des groupes des signaux de commande modulateurs de rayon pour chaque ligne, un des premiers et deuxièmes signaux de commande modulateurs de rayon (52) afin que ledit signal choisi soit sorti en output dudit multiplexeur comme le signal modulateur de rayon sortant.

5. Installation pour la réalisation du procédé selon la revendication 1, caractérisé par un premier dispositif de tampon (32, 34) pour la réception desdites premières données sous forme d'une succession des premières données numériques élémentaires, un deuxième dispositif de tampon (36) pour la réception desdites deuxièmes données sous forme d'une succession desdites deuxièmes données numériques élémentaires, un dispositif générateur des arrangements (38, 40) pour la réception séquentielle desdites premières données, c'est à dire chaque fois une première donnée numérique élémentaire, afin d'engendrer en réponse des signaux de densité d'arrangement graphique représentifs des premières données numériques élémentaires différentes respectives, et par un dispositif logique de rayon (46) pour la génération des signaux de commande de logique de rayon en réponse auxdits signaux de densité d'arrangement graphique, ledit dispositif logique de rayon étant pourvue en même temps pour la réception desdites premières données numériques élémentaires pour la modulation en réponse des signaux de densité d'arrangement graphique, afin

de former des signaux de commande de rayon résultants, par un dispositif (58) fournisseur d'un rayon fin d'énergie rayonnée composé d'une groupe des rayons séparés, ledit dispositif dirigeant ledit rayon vers ledit membre électrophotographique (64) afin de donner lieu à la décharge des éléments dudit membre, chacun des rayons, autant qu'il ne soit effacé, étant susceptible de décharger un élément particulier par l'incidence sur ledit membre électrophotographique, et par un dispositif modulateur (54) pour la modulation desdits rayons en fonction desdits signaux modulateurs de rayon, des images latentes graphiques et texte étant susceptibles d'être appliquées, le cas échéant, indépendamment sur la surface dudit membre électrophotgraphique au cours d'un cycle de balayage de la surface par ledit rayon fin d'énergie rayonnée.

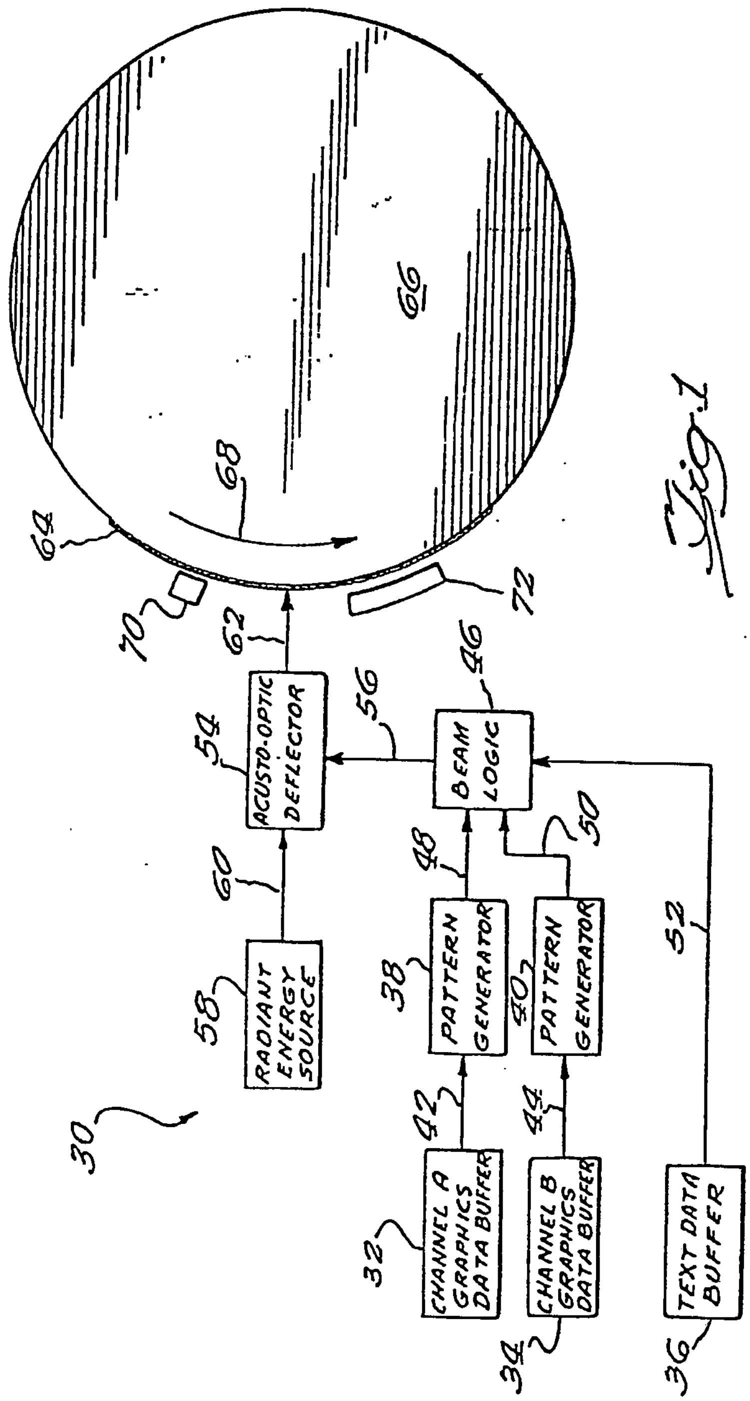

30
58
RADIANT ENERGY SOURCE
60
54
ACUSTO-OPTIC DEFLECTOR
62
70
64
68
66
72
56
46
BEAM LOGIC
48
50
38
PATTERN GENERATOR
40
PATTERN GENERATOR
42
44
52
32
CHANNEL A GRAPHICS DATA BUFFER
34
CHANNEL B GRAPHICS DATA BUFFER
36
TEXT DATA BUFFER

Fig. 1

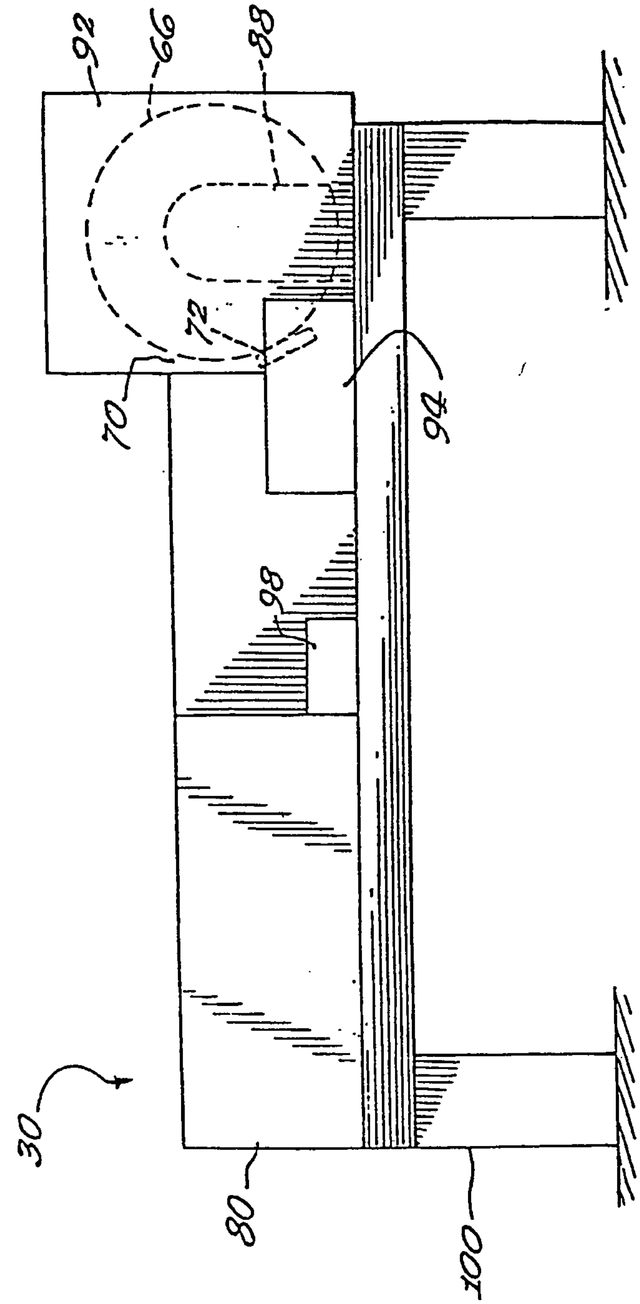


Fig. 2

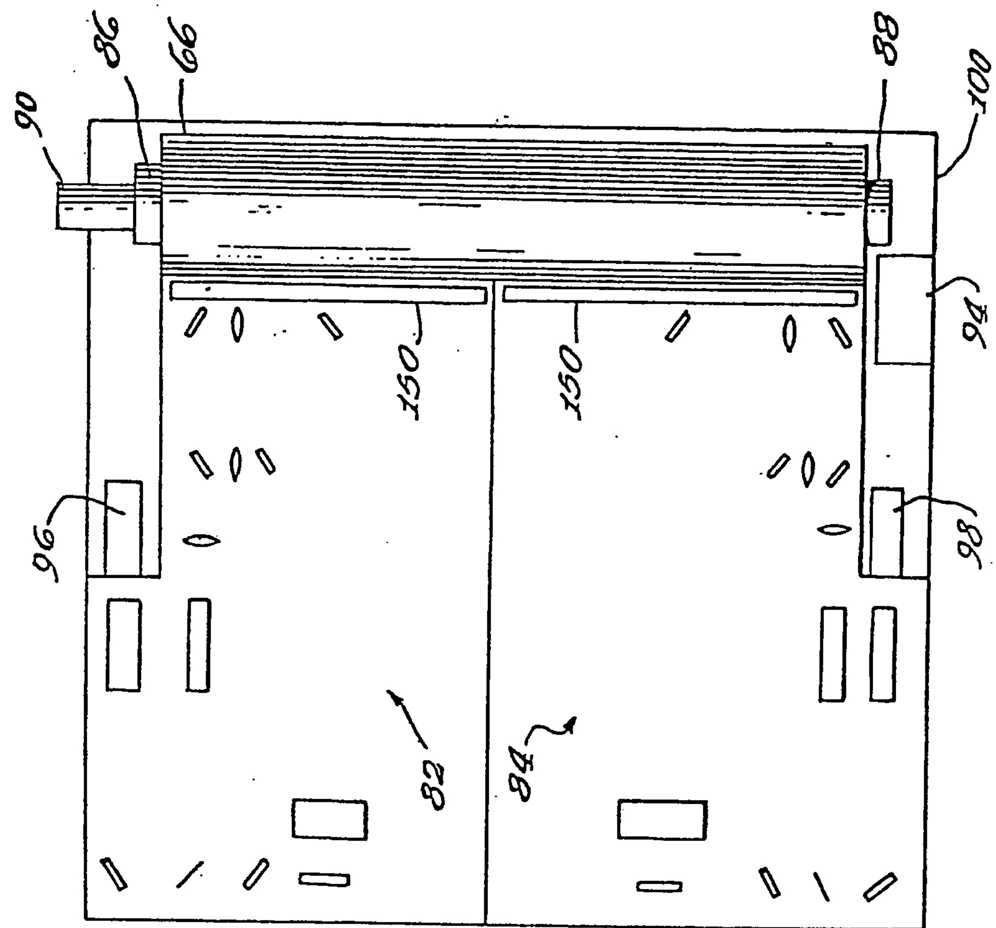


Fig.3

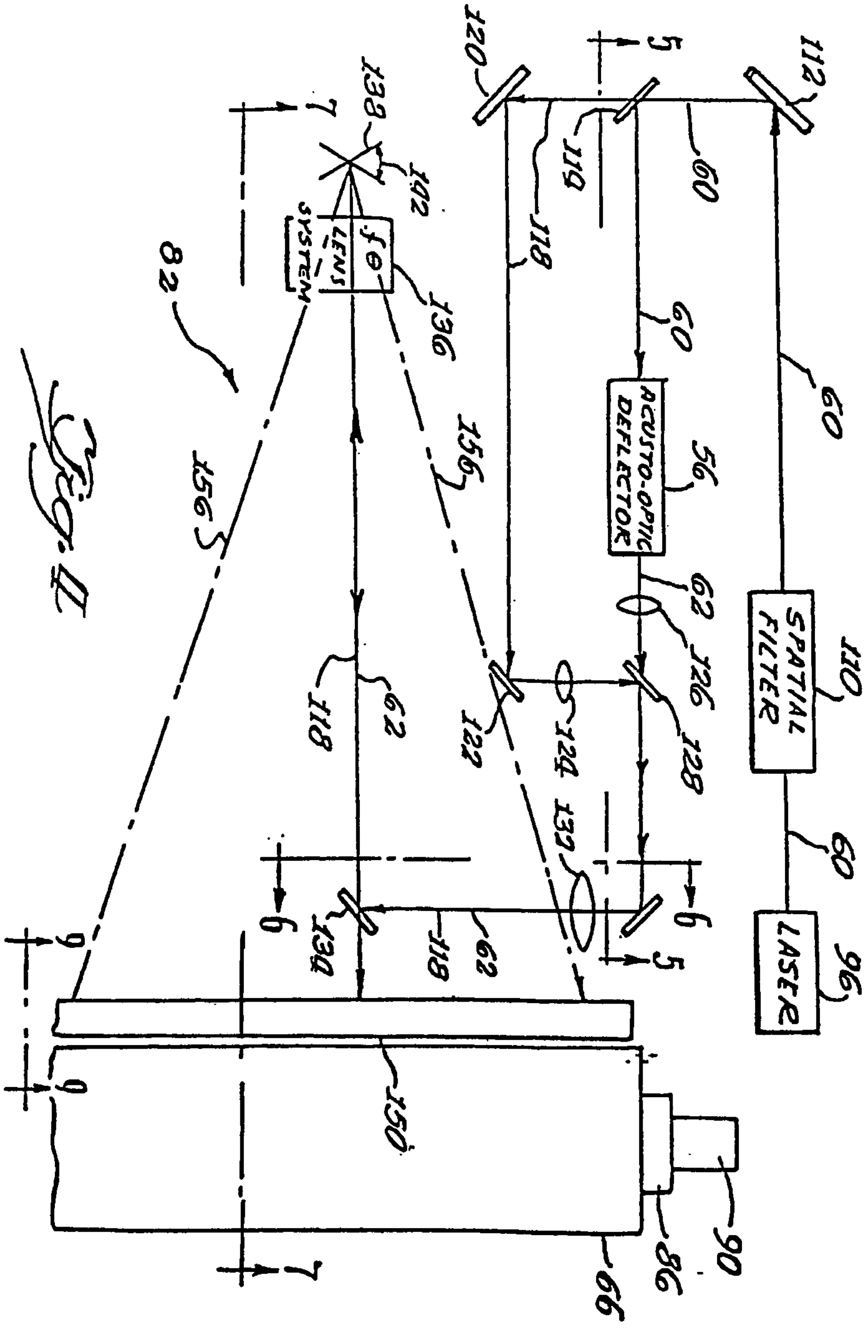

LASER
SPATIAL FILTER
ACUSTO-OPTIC DEFLECTOR
fθ LENS SYSTEM

Fig. 4

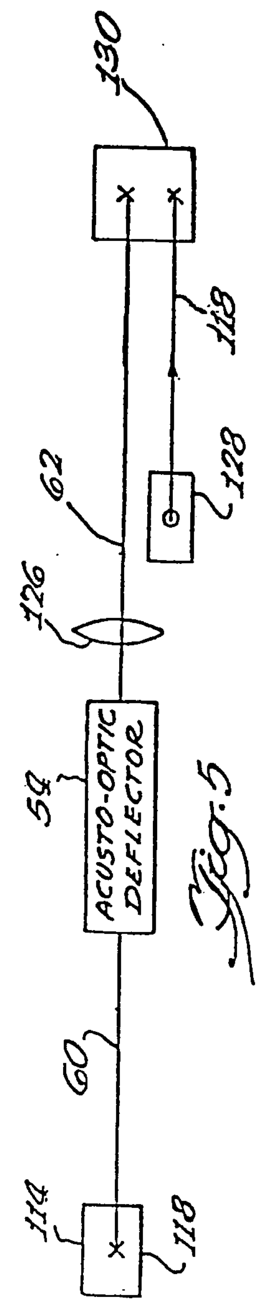

ACUSTO-OPTIC DEFLECTOR
54
60
62
114
118
126
128
130

Fig. 5

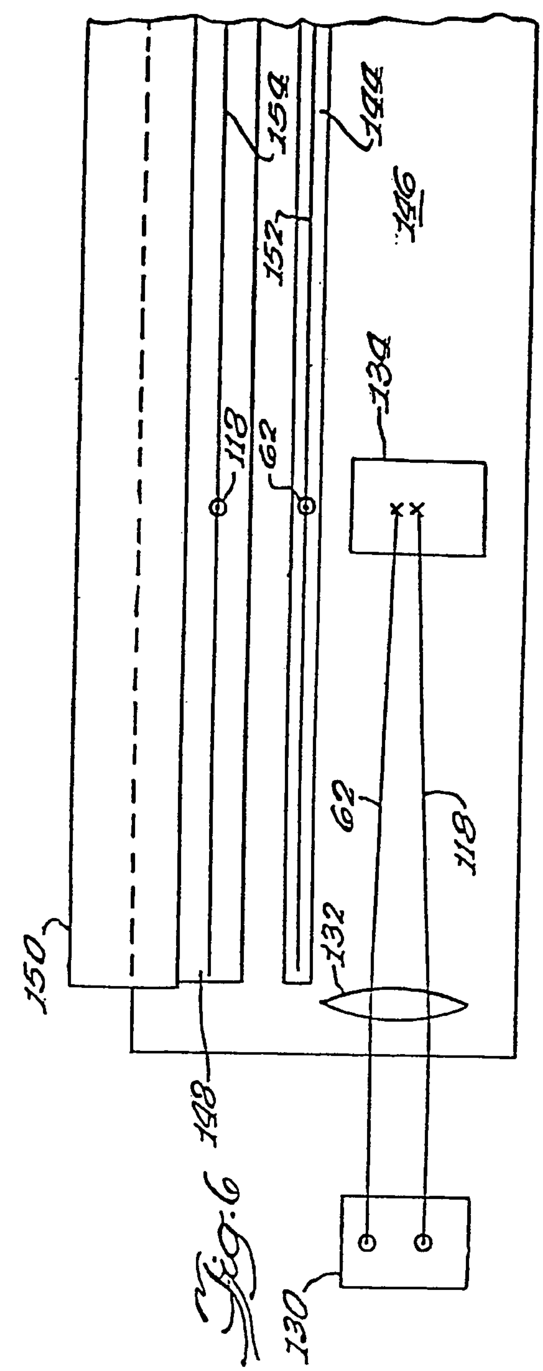

62
118
130
132
134
144
146
148
150
152
154

Fig. 6

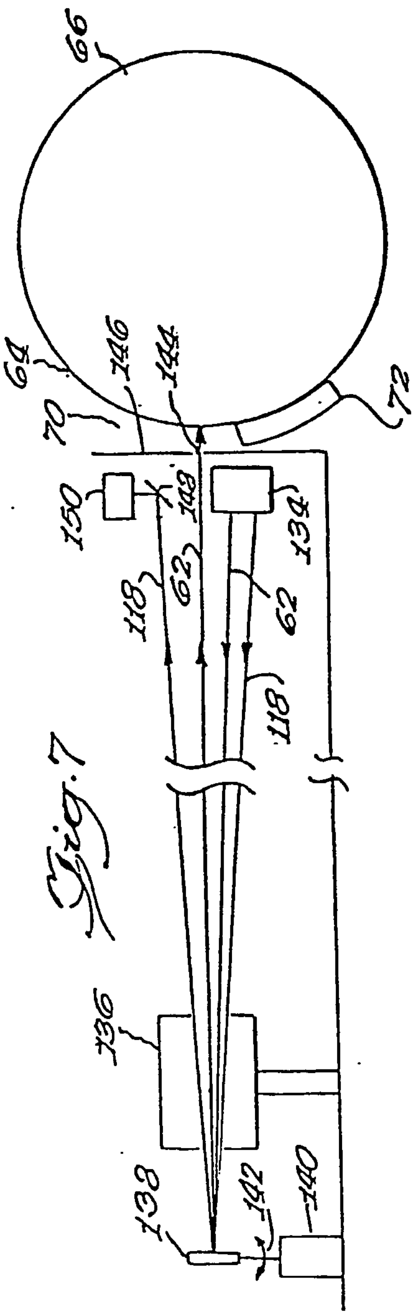


Fig. 7

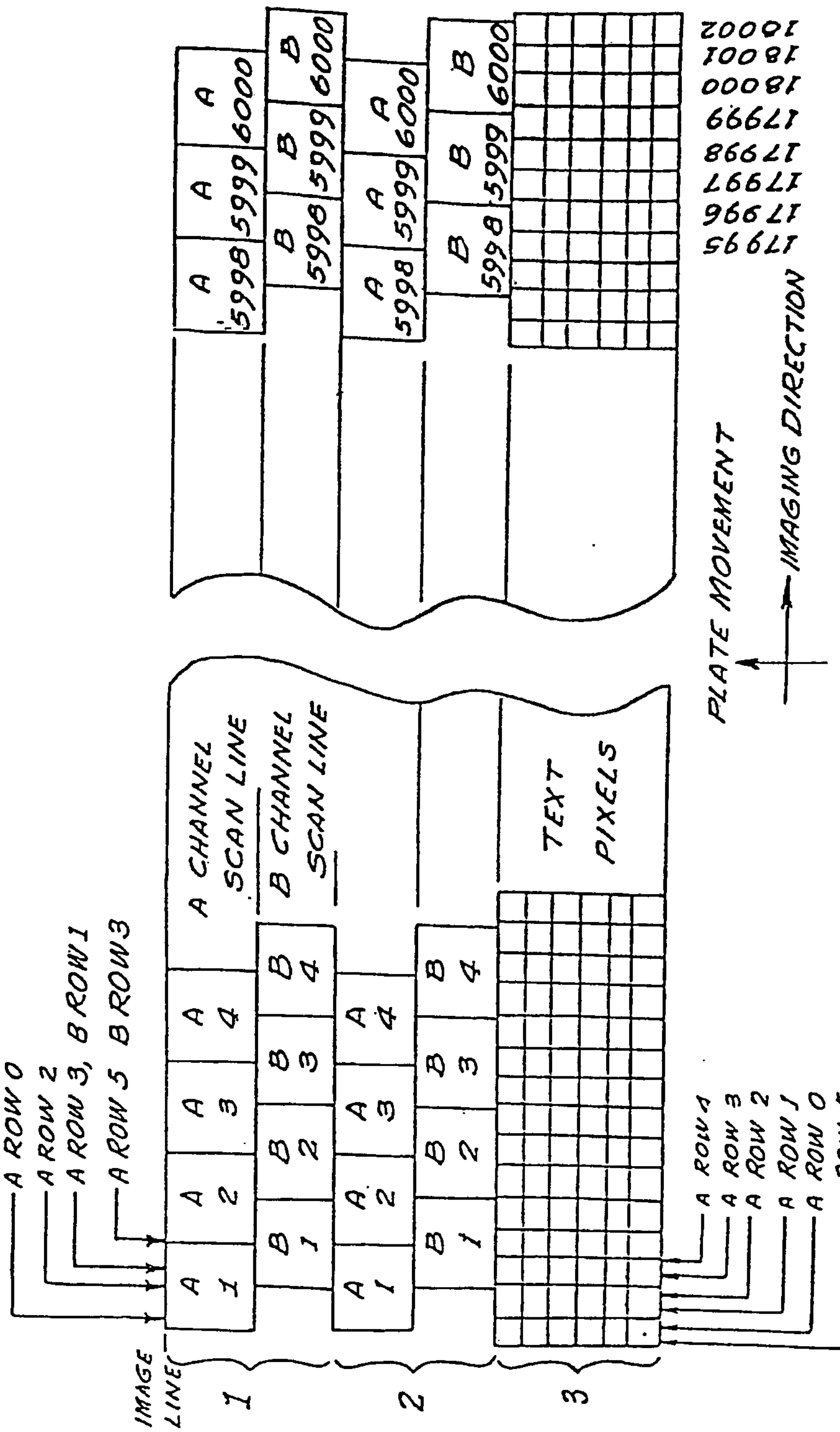

A ROW 0
A ROW 2
A ROW 3, B ROW 1
A ROW 5 B ROW 3
A CHANNEL SCAN LINE
B CHANNEL SCAN LINE
TEXT PIXELS
IMAGE LINE
A ROW 4
A ROW 3
A ROW 2
A ROW 1
A ROW 0
A ROW 5
17995
17996
17997
17998
17999
18000
18001
18002
PLATE MOVEMENT
IMAGING DIRECTION

Fig. 8

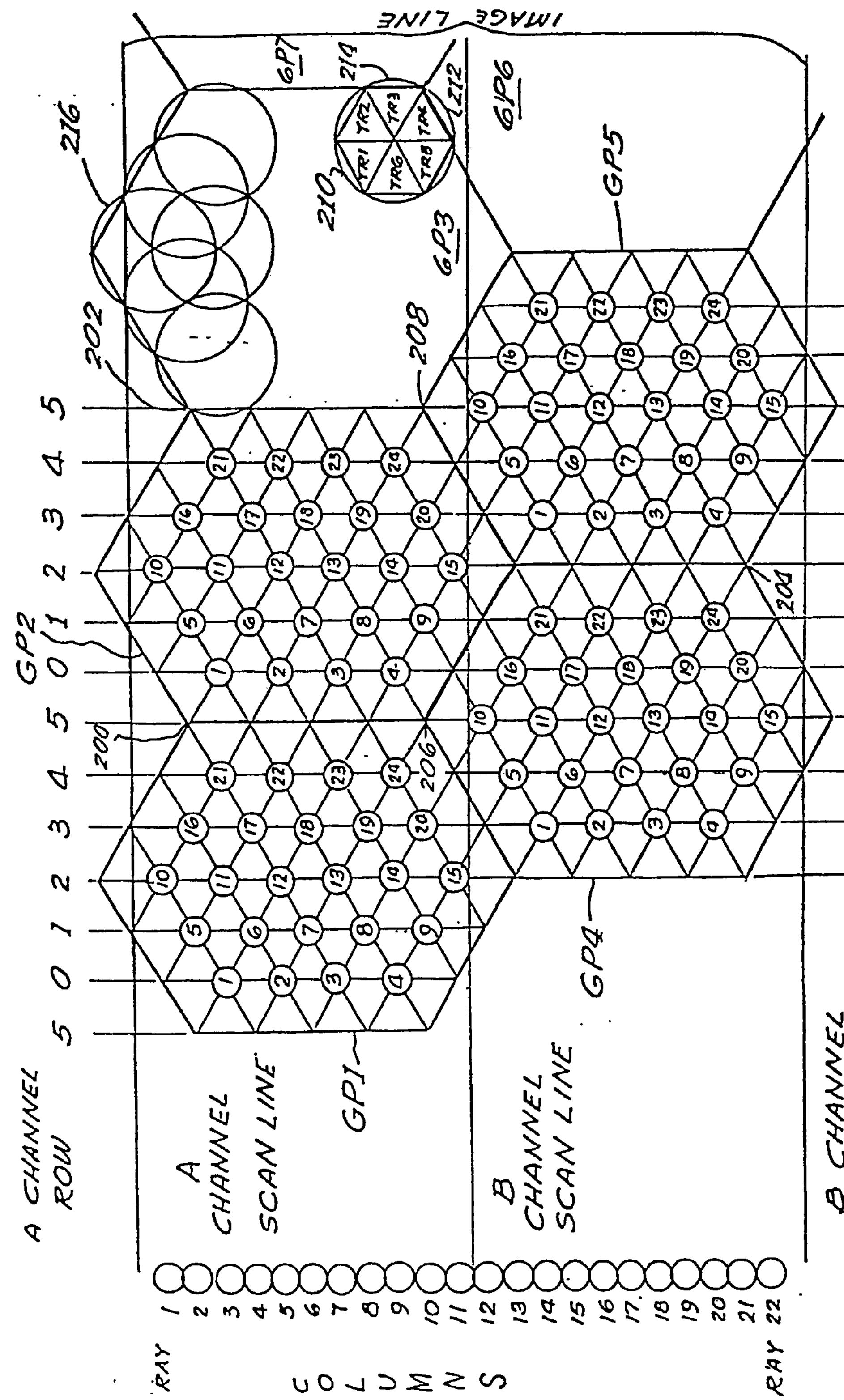


IMAGE LINE
A CHANNEL ROW
A CHANNEL SCAN LINE
B CHANNEL SCAN LINE
B CHANNEL ROW
GP1
GP2
GP3
GP4
GP5
GP6
GP7
200
201
202
206
208
210
212
214
216
TR1
TR2
TR3
TR4
TR5
TR6
RAY
COLUMNS
RAY

Fig. 9

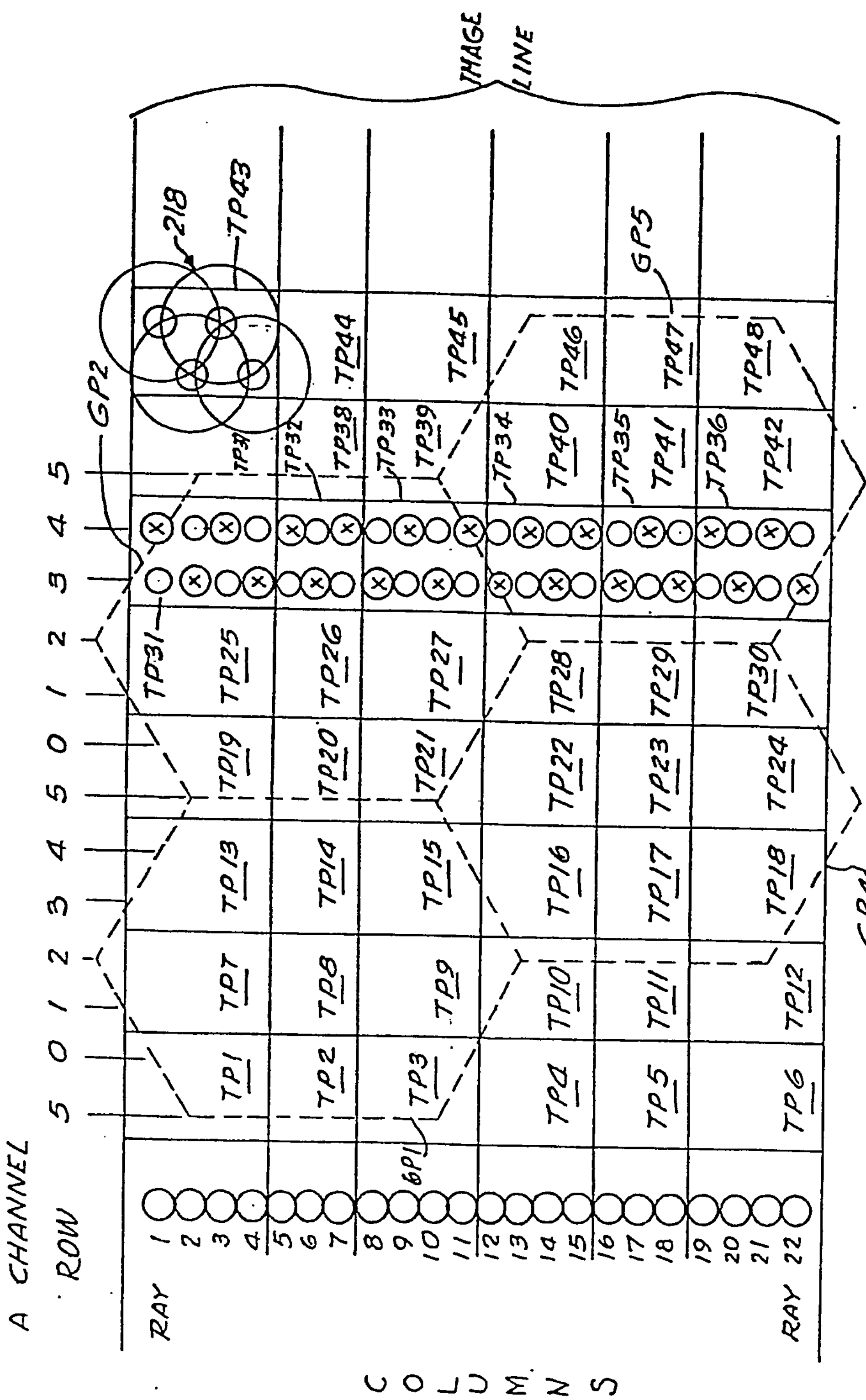


IMAGE LINE
A CHANNEL
ROW
RAY
COLUMNS
218
TP43
GP2
GP4
GP5
GP1
TP1 TP2 TP3 TP4 TP5 TP6
TP7 TP8 TP9 TP10 TP11 TP12
TP13 TP14 TP15 TP16 TP17 TP18
TP19 TP20 TP21 TP22 TP23 TP24
TP25 TP26 TP27 TP28 TP29 TP30
TP31 TP32 TP33 TP34 TP35 TP36
TP37 TP38 TP39 TP40 TP41 TP42
TP44 TP45 TP46 TP47 TP48

Fig. 10

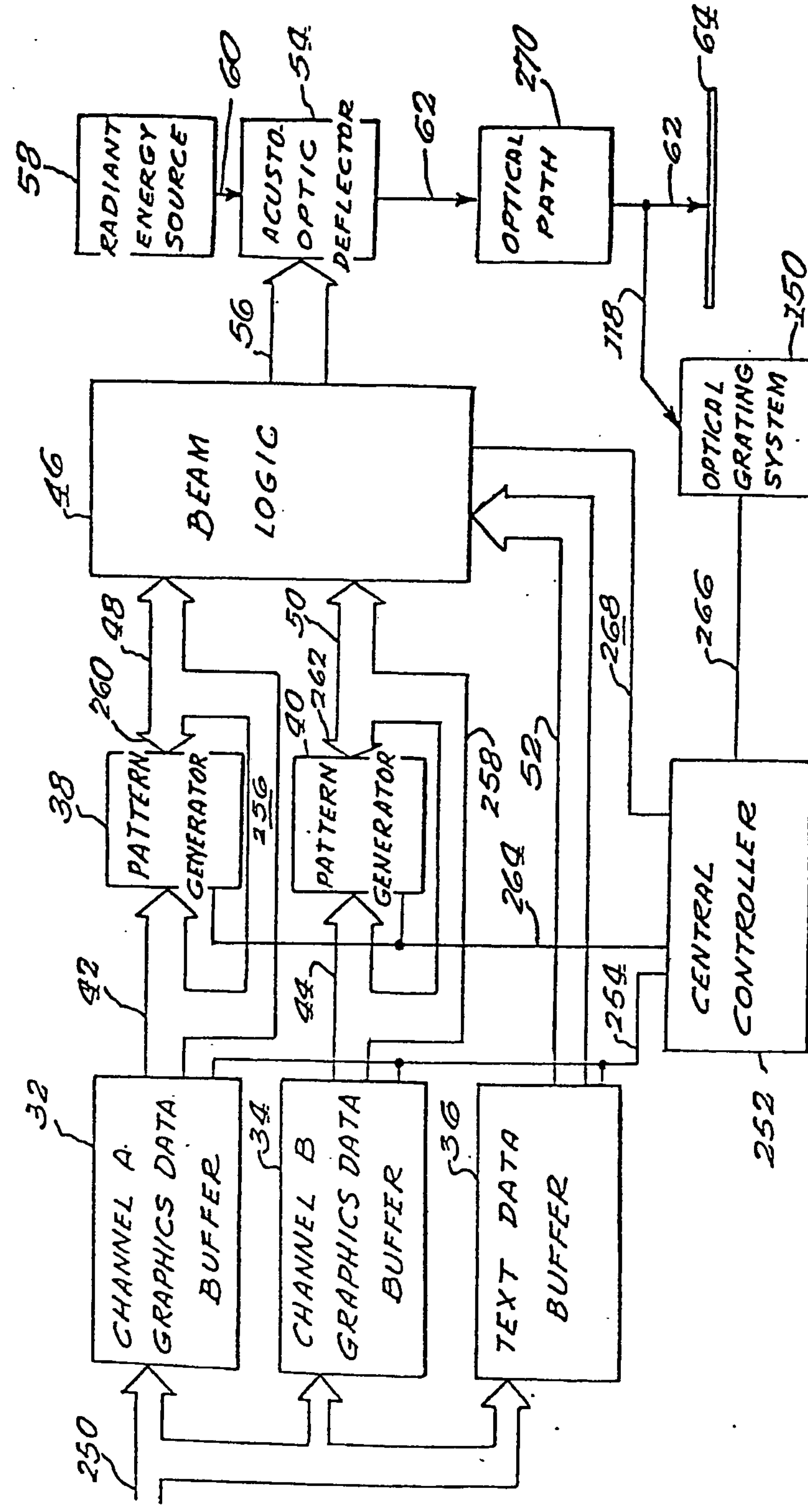
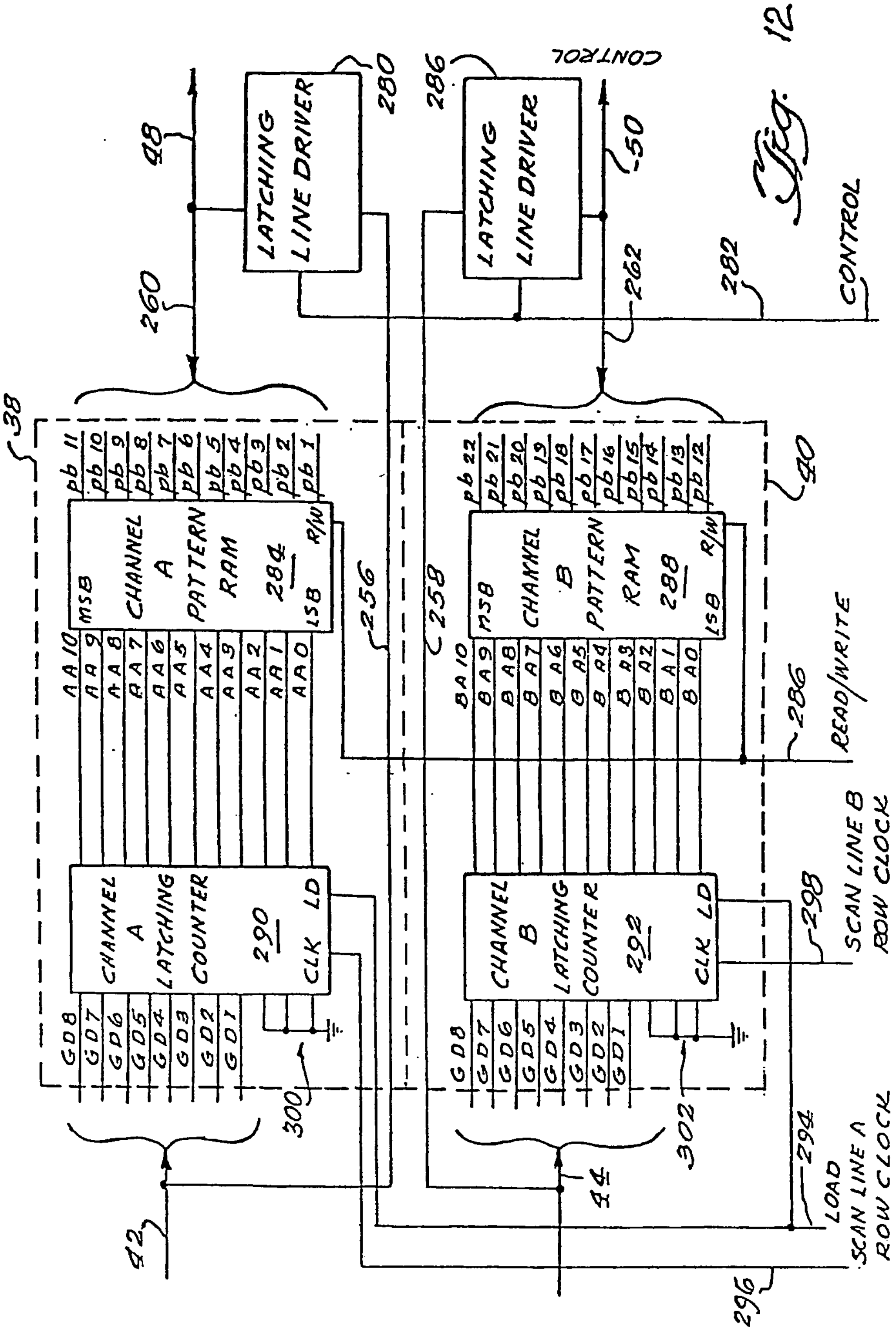
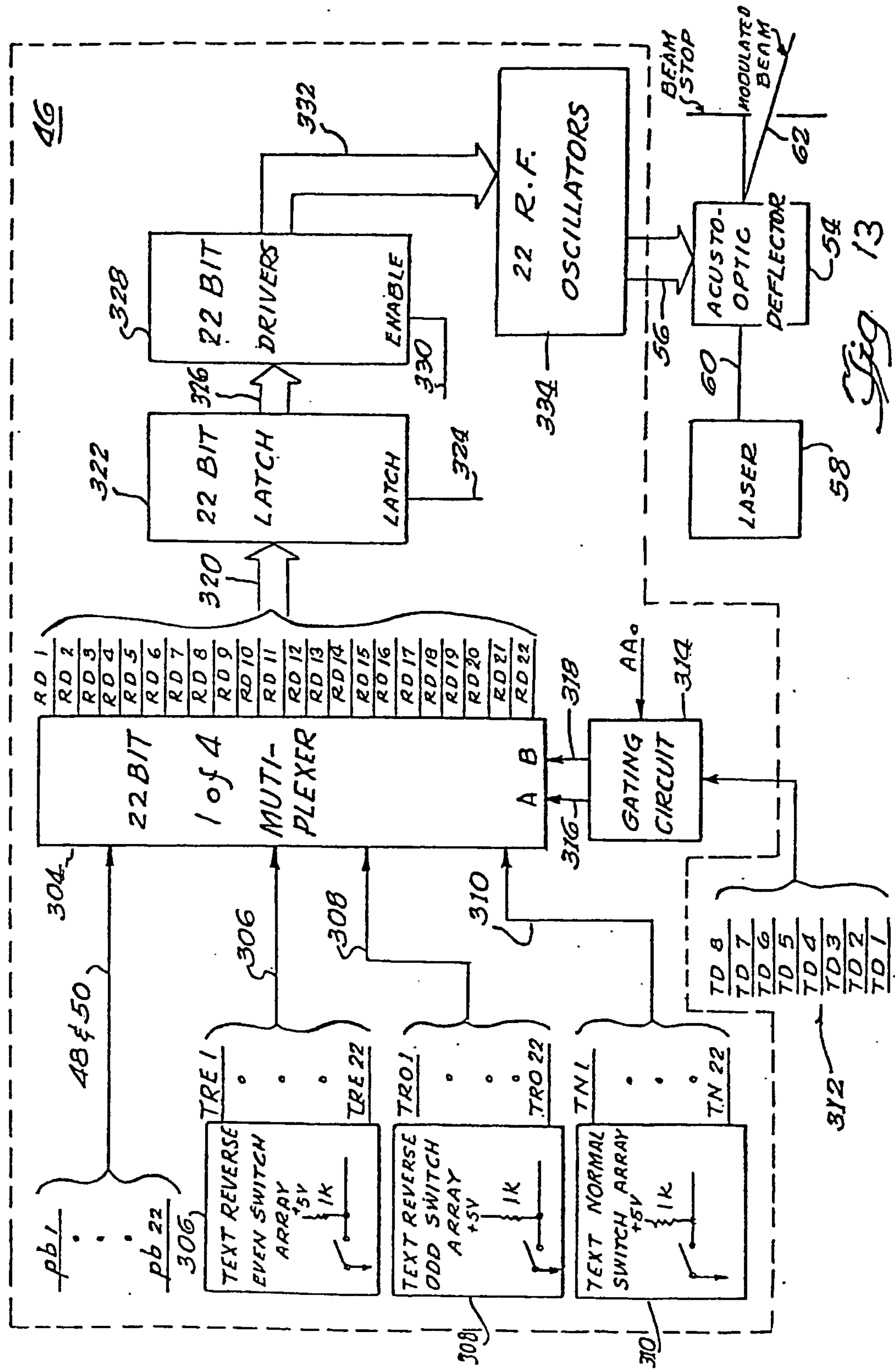

RADIANT ENERGY SOURCE
58
ACUSTO OPTIC DEFLECTOR
54
60
62
OPTICAL PATH
270
64
118
OPTICAL GRATING SYSTEM
150
BEAM LOGIC
46
56
48
50
260
262
PATTERN GENERATOR
38
40
256
258
52
268
266
264
254
CENTRAL CONTROLLER
252
42
44
CHANNEL A GRAPHICS DATA BUFFER
32
CHANNEL B GRAPHICS DATA BUFFER
34
TEXT DATA BUFFER
36
250

Fig 11


LATCHING LINE DRIVER
280
LATCHING LINE DRIVER
286
CONTROL
48
50
260
262
282
CONTROL
38
40
pb 11
pb 10
pb 9
pb 8
pb 7
pb 6
pb 5
pb 4
pb 3
pb 2
pb 1
pb 22
pb 21
pb 20
pb 19
pb 18
pb 17
pb 16
pb 15
pb 14
pb 13
pb 12
MSB
CHANNEL A PATTERN RAM
284
R/W
LSB
MSB
CHANNEL B PATTERN RAM
288
R/W
LSB
256
258
AA10
AA9
AA8
AA7
AA6
AA5
AA4
AA3
AA2
AA1
AA0
BA10
BA9
BA8
BA7
BA6
BA5
BA4
BA3
BA2
BA1
BA0
286
READ/WRITE
CHANNEL A LATCHING COUNTER
290
CLK LD
CHANNEL B LATCHING COUNTER
292
CLK LD
298
SCAN LINE B ROW CLOCK
GD8
GD7
GD6
GD5
GD4
GD3
GD2
GD1
GD8
GD7
GD6
GD5
GD4
GD3
GD2
GD1
300
302
294
LOAD SCAN LINE A ROW CLOCK
42
44
296
Fig. 12



46
22 R.F. OSCILLATORS
22 BIT DRIVERS
ENABLE
22 BIT LATCH
LATCH
22BIT 1 of 4 MUTI-PLEXER
A B
GATING CIRCUIT
AA0
RD 1 … RD 22
TD 8 TD 7 TD 6 TD 5 TD 4 TD 3 TD 2 TD 1
ACUSTO-OPTIC DEFLECTOR
LASER
BEAM STOP
MODULATED BEAM
TEXT REVERSE EVEN SWITCH ARRAY
TEXT REVERSE ODD SWITCH ARRAY
TEXT NORMAL SWITCH ARRAY
+5V
1k
TRE 1
TRE 22
TRO 1
TRO 22
TN 1
TN 22
pb 1
pb 22
48 & 50
304
306
308
310
312
314
316
318
320
322
324
326
328
330
332
334
54
56
58
60
62

Fig 13

	USED TO CONTROL
TD 8	NOT USED
TD 7	CONTROL 1=NORMAL 0=REVERSE
TD 6	RAYS 19-22
TD 5	RAYS 16-18
TD 4	RAYS 12-15
TD 3	RAYS 8-11
TD 2	RAYS 5-7
TD 1	RAYS 1-4

Fig. 14

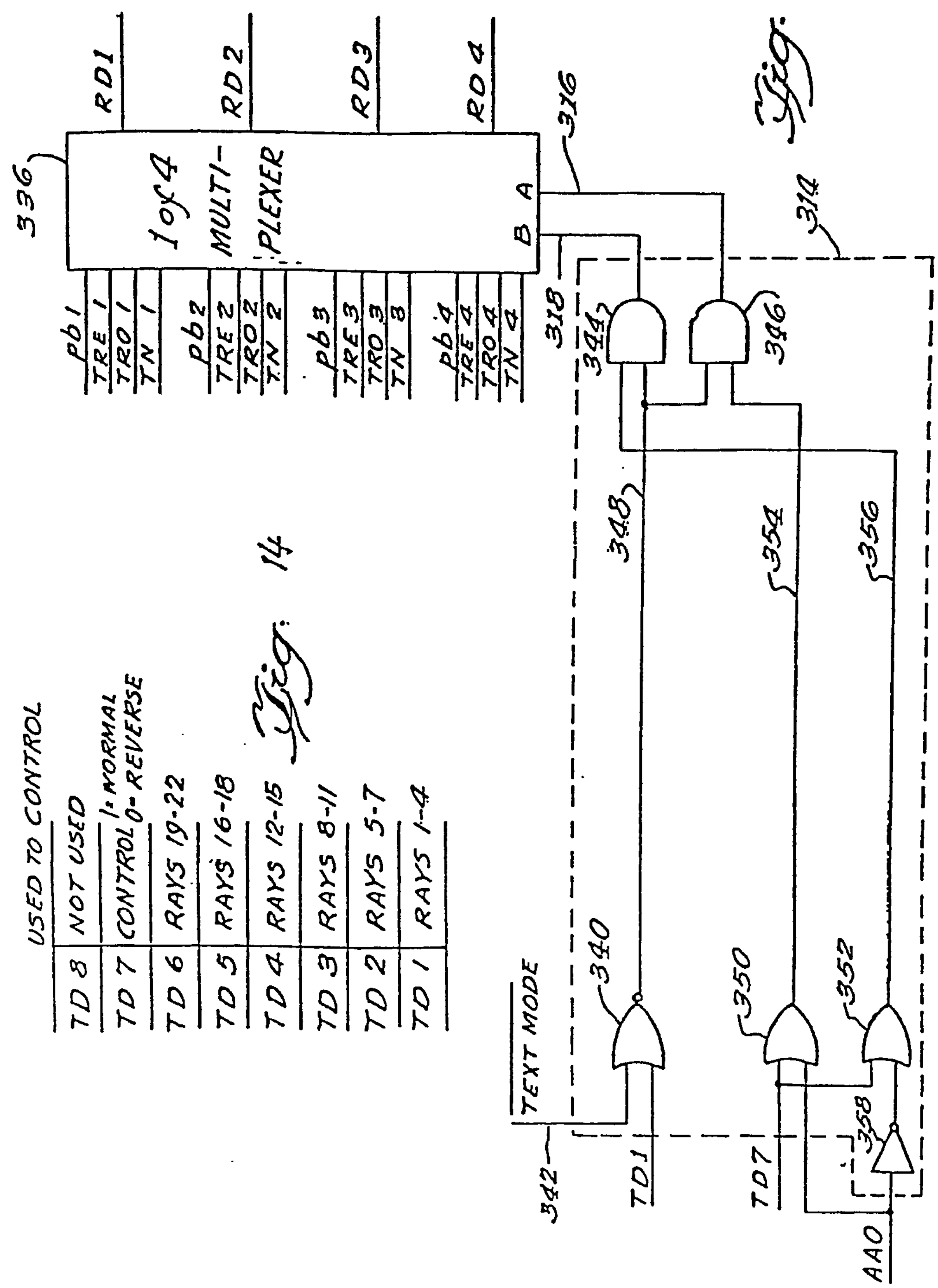


Fig. 15